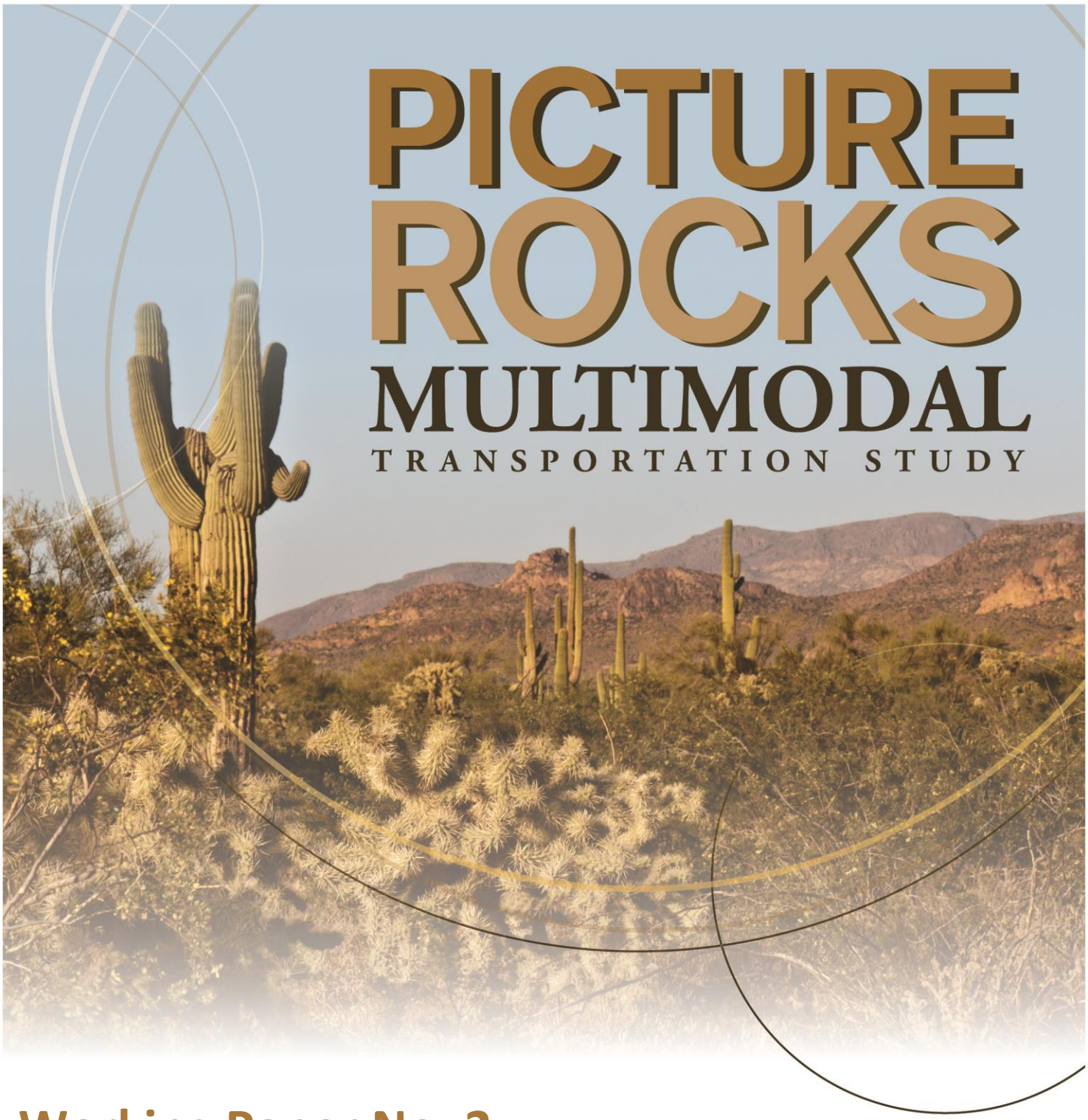

Working Paper No. 2

Plan for Improvements

June 2014

PREPARED FOR: ADOT AND THE SEAL OF PIMA COUNTY ARIZONA

PREPARED BY: Kimley»Horn

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1. Introduction

1.1 STUDY BACKGROUND AND PURPOSE

Citizens for Picture Rocks is a community advocacy group representing the Picture Rocks Fire Department, Pima County Sheriff's Department, Picture Rocks American Association of Retired Persons (AARP), Picture Rocks Elder Initiative, and other community stakeholders. The group approached Pima County representatives to express concerns regarding transportation issues in the community. These concerns related to lack of transit service, safety-related issues, and the need for pedestrian and bicycle facilities. As a result, with a letter of support from the Citizens for Picture Rocks, Pima County submitted an application to the Arizona Department of Transportation (ADOT) Planning Assistance for Rural Areas (PARA) Program to conduct a multimodal transportation study to address transportation issues in the community.

The purpose of the Picture Rocks Multimodal Transportation Study is to identify the most critical multi-modal transportation infrastructure and service needs within the Picture Rocks study area and recommend a program of short-range (0-5 years), mid-range (6-10 years), and long-range (11-20 years) improvements that address:

- Roadway safety;
- Regional access and mobility;
- Bicycle and pedestrian safety and mobility; and
- Rural transit service.

The study will serve as a guide for community and economic development, project funding applications and grants, and project implementation.

Study activities include the following:

- Collect and review existing and future conditions related to traffic volumes, crashes, socioeconomic and demographic conditions, and roadway conditions;
- Evaluate the performance of the transportation system and document needs and deficiencies;
- Project future travel demand and transportation needs for 5-, 10-, and 20-year planning horizons;
- Evaluate the demand and opportunities for providing expanded rural transit service; and
- Recommend improvements that address the identified needs and deficiencies.

1.2 STUDY OBJECTIVES

The primary objectives of the study are to:

- Improve safety through recommendations for shoulder improvements, geometric improvements, and traffic control;
- Identify feasible alternatives and recommendations for non-county-maintained roads to improve drivability, reduce dust pollution, and reduce vehicle maintenance costs. Currently there are approximately 140 miles of roads in the study area that are not maintained by the County, many of which are unpaved. By comparison, there are approximately 46 miles of paved roads that are maintained by the County or other jurisdictions in the study area, and approximately nine miles of dirt roads that are maintained by the County;
- Confirm the need for and provide recommendations for transit service;

- Improve multimodal mobility with projects for sidewalks, paths, and shoulders to accommodate bicyclists and pedestrians; and
- Recommend improvements that address the identified needs and deficiencies.

1.3 STUDY AREA

Picture Rocks, Arizona is located in unincorporated Pima County approximately 20 miles northwest of the City of Tucson. The community is located west of the Tucson Mountains. The study area borders the southern town limits of Marana and is adjacent to Saguaro National Park (SNP). A vicinity map is shown in **Figure 1** and a study area map is shown in **Figure 2.**

1.4 ORGANIZATION OF WORKING PAPER 2

Working Paper No. 2 (this working paper) develops a prioritized plan of transportation improvement projects. This Working Paper is organized into the following chapters:

- **Chapter 1: Introduction** – Describes the study background, purpose, objectives, and study area.
- **Chapter 2: Transportation Needs** – Summarizes transportation needs that will be addressed by the recommended projects. Transportation needs were documented in Working Paper No. 1 (Current and Future Needs Assessment) and organized in this Working Paper to facilitate project recommendations.
- **Chapter 3: Recommended Projects** – Describes recommended projects, development issues, and planning-level cost estimates.
- **Chapter 4: Project Prioritization and Plan for Improvements** – Describes project priorities in terms of short-, mid-, and long-range timeframes.
- **Chapter 5**: **Funding Sources** – Summarizes potential project funding sources.

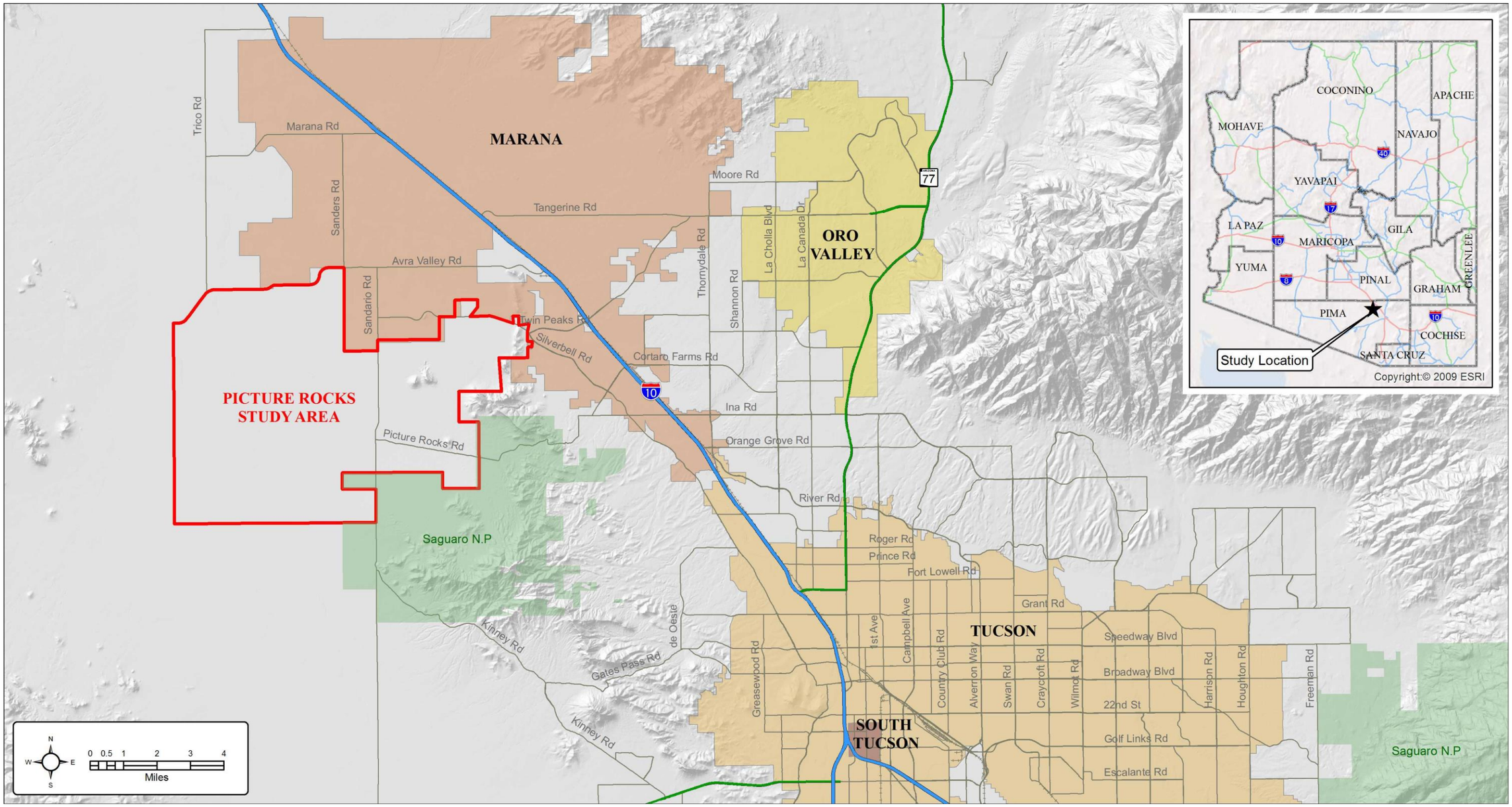


Figure 1 – Vicinity Map

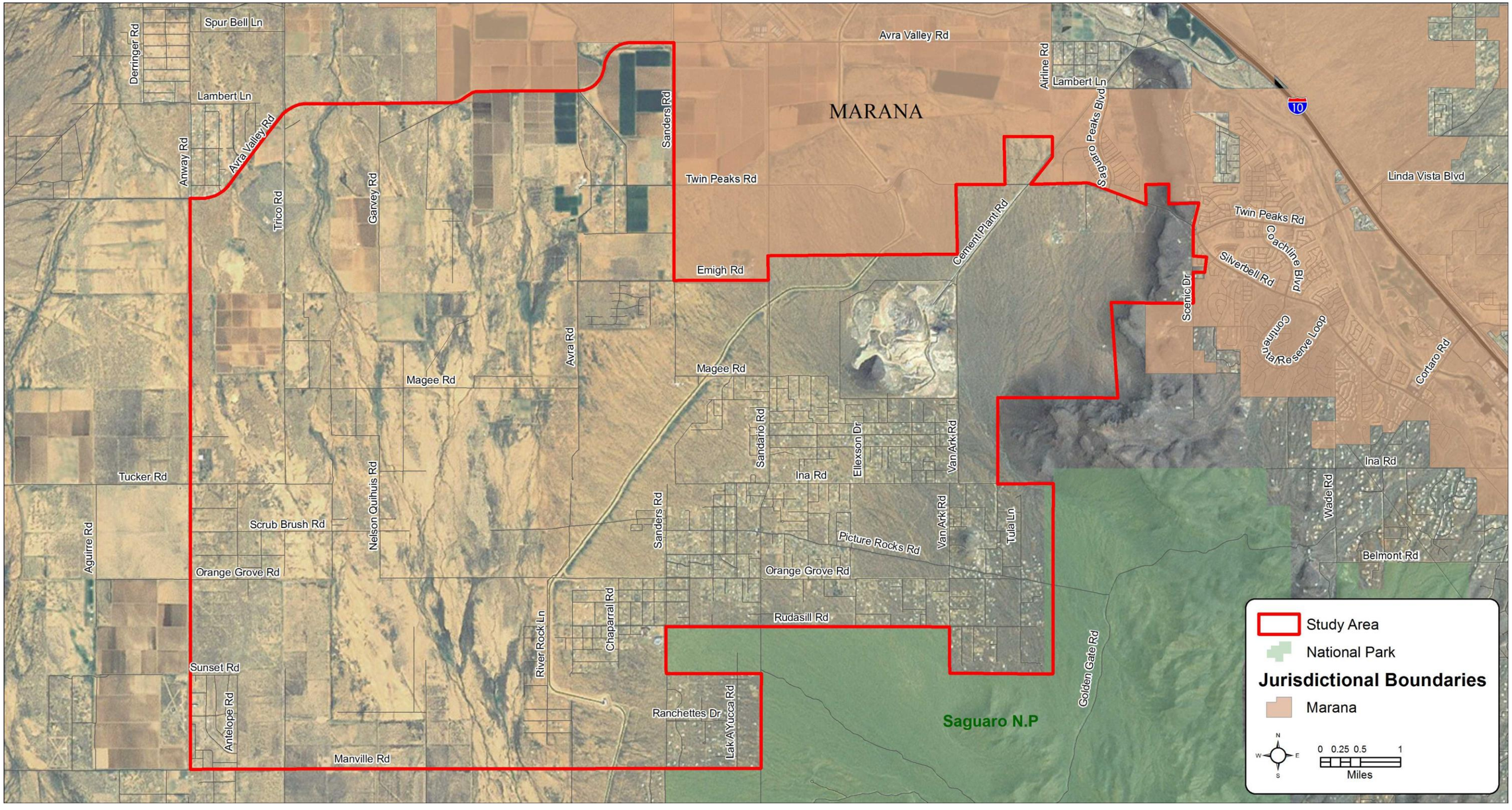


Figure 2 – Study Area Map

2. Transportation Needs

This chapter provides an overview of multimodal transportation needs within the study area. The needs were documented in Working Paper No. 1 (Current and Future Needs Assessment). Needs resulted from assessments of the following information and analyses:

- Stakeholder input from the Technical Advisory Committee (TAC), civic groups, and the general public;
- Completed and ongoing plans and studies;
- Traffic data analysis;
- Crash data analysis;
- Transit ridership analysis;
- Community and environmental resources; and
- Field review of road and pavement conditions.

The needs documented in Working Paper No. 1 have been organized to inform the development of projects in this Working Paper. Needs have been organized into the following categories:

- Planning and engineering studies;
- Transportation infrastructure;
- Roadway-flooding mitigation;
- Alternate transportation modes; and
- Roadway maintenance.

2.1 NEEDED PLANNING AND ENGINEERING STUDIES

Field observations and limited data analysis were performed in support of project recommendations. However, more detailed planning and engineering studies and design analysis are needed to confirm the presence of deficiencies that can be addressed though improvement projects and to provide input to project scoping. Typical studies include hydrological studies, diagnostic crash studies, and traffic studies.

Hydrological Studies - Mitigation of flood-prone areas to reduce road closures for area residents and improve accessibility for emergency service providers are among the highest priority needs expressed by stakeholders. Roadway locations that are prone to flooding, as documented in Working Paper No. 1, are shown in **Figure 3**. Hydrological studies should review available completed studies (Brawley Wash drainage studies) to confirm roadway locations that are prone to flooding and to estimate project limits, depths of flow, and flow rates. These studies should determine priorities and implementation strategies that minimize flooding impacts on access.

Diagnostic Safety Studies - A review of crash locations in the study area identified a number of road segments and intersections with high concentrations of total and injury crashes (see **Figure 4**). Limited crash analyses and field visits were conducted in support of project recommendations.

Traffic Studies - A number of locations in the study area were identified by stakeholders as needing operational, traffic control, and/or safety improvements. Traffic studies are needed to confirm the need for changes in traffic control or to supplement diagnostic crash studies. Stakeholder input on traffic studies are listed below.

- Review the passing zone on Sandario Road, north of Picture Rocks Road to determine the safety benefits of a no-passing zone;
- Review need to upgrade bus stop advance warning signs (S3-1) and other school signs to current Manual on Uniform Traffic Control Device (MUTCD) standards;
- Review need to upgrade and increase the size for cross-street name signs at intersections and on approaches to major intersections;
- Review the need to upgrade curve advance warning signs on Sandario Road from Camper Road to Ina Road;
- Coordinate with the National Park Service on the need to inform and direct traffic destined to the SNP to Twin Peaks Road and Sandario Road to reduce traffic on Picture Rocks Road;
- Review the need for variable message signs to redirect traffic during flooding events and crashes;
- Review the need for changes in posted speed limits, speed enforcement, or speed message signs to reduce travel speeds on Sandario Road, Picture Rocks Road, and Orange Grove Road; and
- Review the need for additional enforcement of weight limits on Picture Rocks Road.

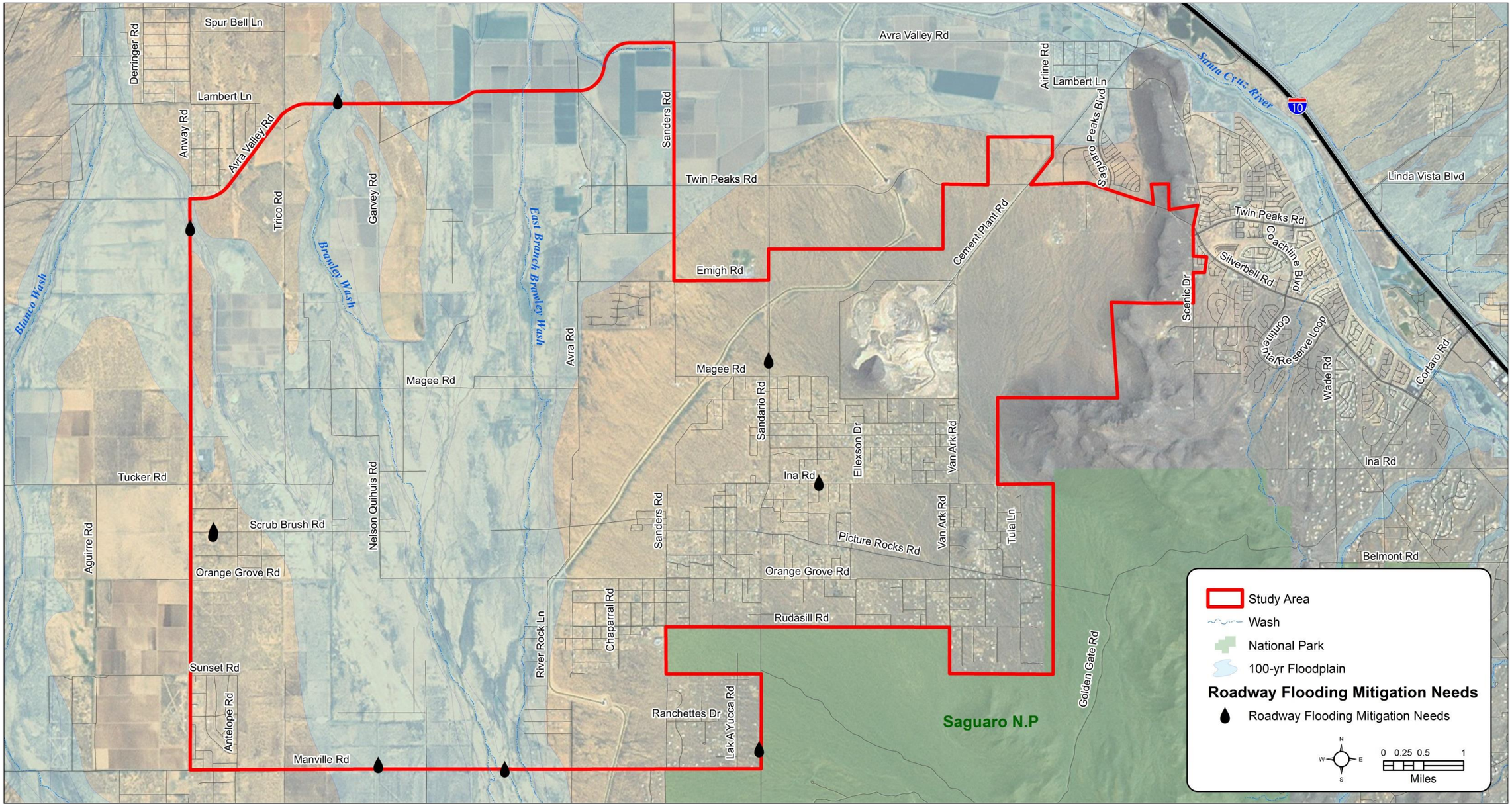
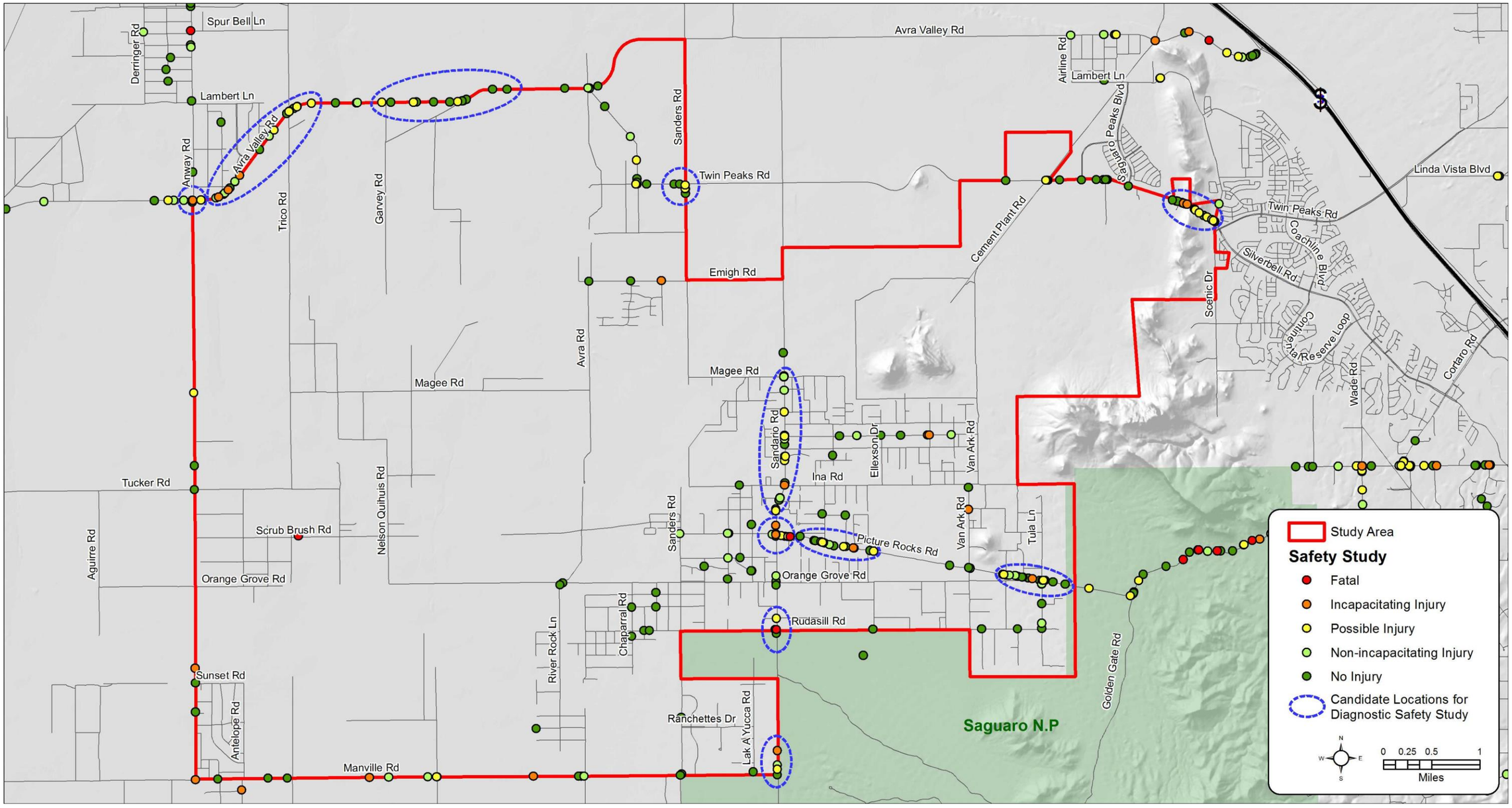


Figure 3 – Roadway Flooding Areas



Source: ADOT Safety Data Mart

Figure 4 – Diagnostic Safety Study Locations

2.2 TRANSPORTATION INFRASTRUCTURE NEEDS

2.2.1 ROADWAY SEGMENTS

Sandario Road – Rudasill Road to Emigh Road

Sandario Road is a county-maintained paved roadway and is the major north-south corridor in the study area with daily traffic volumes of 4,500 vehicles per day (vpd). Development along Sandario Road has resulted in residential and business driveways near the Picture Rocks Road intersection. The intersection improvements and future development should be compatible with a land use planning framework developed in accordance with Pima County special area policies to accommodate all transportation modes and parking in rural activity areas.

Stakeholder interviews documented road maintenance, traffic operational, safety, alternate modes, and traffic control needs for Sandario Road. According to stakeholders, the fire station located on Sandario Road, north of Picture Rocks Road needs a preemptive traffic signal to warn motorists of emergency vehicles entering the roadway (note: these types of signals typically do not meet warrant criteria used by Pima County; however, Pima County does work with fire districts to install preemptive traffic signals using fire district funding sources). There is also a need for bicycle facilities along Sandario Road for recreational bicyclists and residents. Other needs recommended in road safety assessments (RSAs) conducted by Pima County on Sandario Road in 2012 included new or upgraded signage to improve night-time visibility of street signs, and road widening to three lanes (one lane in each direction with a two-way left-turn lane) with paved shoulders as the principle strategy for reducing crash potential associated with vehicles entering and exiting driveways in areas with limited sight visibility.

Stakeholder input was received on the need for intersection improvements and increased enforcement on Sandario Road which is supported by the crash history over the last five years that includes a fatal crash. Field visits were made to the intersections at Picture Rocks Road, Orange Grove Road, and Rudasill Road, as well as the segment of Sandario Road, north of Picture Rocks Road to determine safety improvement issues that need to be addressed. The field visits resulted in the following observations:

- The posted speed limit of 40 miles per hour (mph) may be incompatible with the Picture Rocks rural community area. Speed studies should be conducted to investigate the need for a lower speed limit on Sandario Road in and approaching the Picture Rocks community area.
- The passing zone on Sandario Road north of Picture Rocks Road should be reviewed by Pima County to determine the need for a no-passing zone approaching the Picture Rocks community area.
- The combination of vehicular speed, limited sight distance, and vehicles entering and exiting at driveways on Sandario Road, contribute to crashes on Sandario Road, north and south of Picture Rocks Road. A preemptive traffic signal at the fire station is needed to reduce the potential for crashes with emergency vehicles.
- Significant safety issues were not observed at the intersection of Sandario Road and Rudasill Road.

Sandario Road is not an all-weather road in the vicinity of low-flow crossings of the Brawly Wash. Stakeholders identified the need for drainage improvements at the Brawley Wash crossing on Sandario Road north of Magee Road.

The Pima County Comprehensive Plan contains Special Area Policies for the Picture Rocks rural activity center (refer to **Figure 5**). The Special Area Policy describes the goal of using streetscape to encourage slower traffic speeds. Potential streetscape elements include on-street parking, sidewalks, planters, and street trees. The Special Area Polices describe that development should enhance the pedestrian-scale environment and enhance the area as a "main street" for the Picture Rocks community. Illustrative three-lane cross-sections that reflect these policies are shown in **Figure 6** and are described in more detail in the project recommendations in Chapter 3.

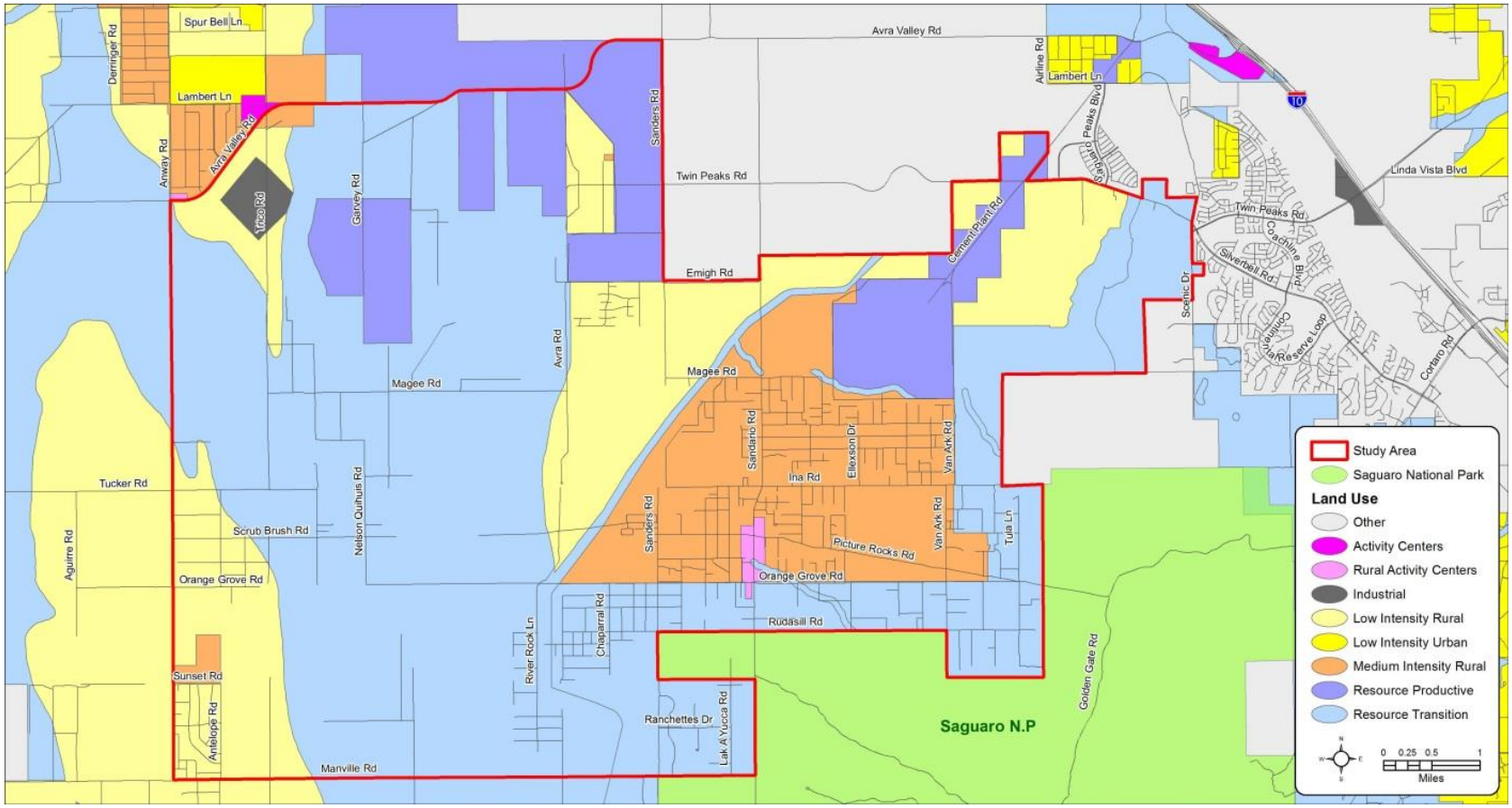


Figure 5 – Study Area Land Use

Source: Pima County

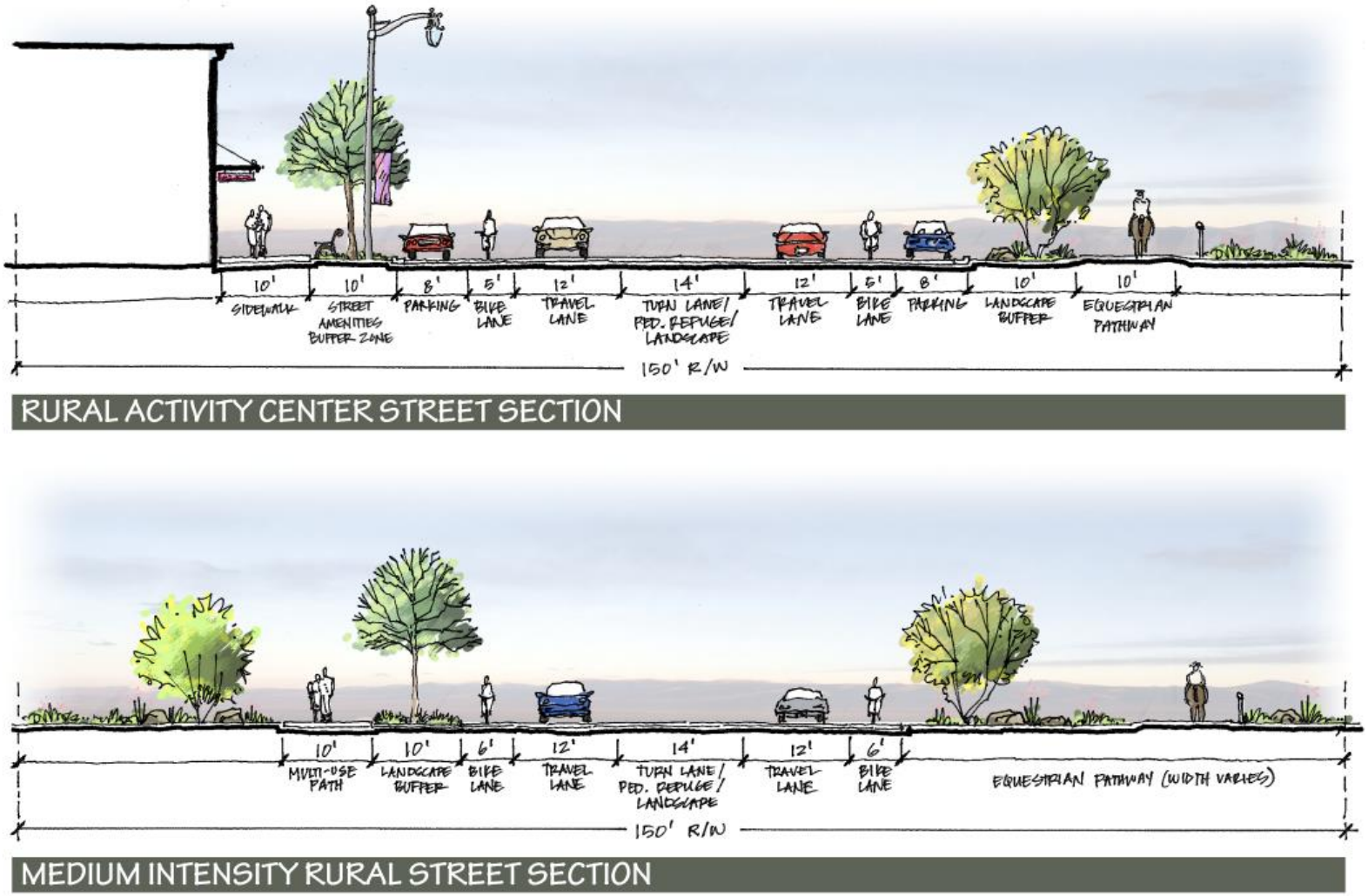


Figure 6 – Rural Activity Center and Medium Intensity Street Sections

Picture Rocks Road – Guthrie Road to Saguaro National Park

Picture Rocks Road is a county-maintained paved road providing east-west access to Picture Rocks from SNP and I-10 via Wade Road and Ina Road. Picture Rocks Road within the study area is classified as a two-lane scenic collector with average daily traffic volumes of 8,000 to 9,000 vpd.

Pima County is currently conducting a scoping study for this segment of Picture Rocks Road that will review alternatives including shoulder improvements and intersection turn lanes, and widening to a three-lane cross-section with two-way left-turn lanes and with shoulder improvements. The study is to be completed by August 2014.

Field visits to review safety conditions confirmed that the combination of traffic volumes, travel speeds, unpaved shoulders, the presence of bicycle and pedestrian traffic, limited sight distance in areas of driveways and intersections, and road maintenance contribute to the concentration of crashes along this roadway segment. Field visits supported the recommendations from the Pima County Department of Transportation RSAs on Picture Rocks Road (geometric roadway realignment in the vicinity of the Picture Rocks Wash and roadway widening to three lanes with paved shoulders). Improvements to Picture Rocks Road are in addition to improvements at the Sandario/Picture Rocks intersection. Federal Highway Safety Improvement Program (HSIP) funding is being considered as a funding resource for improvements to Picture Rocks Road.

During the field visit, improvements were observed on Picture Rocks Road by the National Park Service to manage vehicle speeds and warn motorists in advance of curves (refer to the photo images to the right). If effective, these speed management and warning strategies may be applicable for other locations in the study area.

Rudasill Road – Sanders Road to Van Ark Road

Rudasill Road is a county-maintained paved roadway providing east-west access within the study area and provides the principal access to the Picture Rocks Community Center located on Sanders Road. Documented stakeholder needs resulted from the combination of travel speeds, limited sight distance, lack of pedestrian and bicycle facilities, graded shoulders, and low light levels which create the potential for traffic crashes. However, there was not a significant concentration of crashes on this segment of Rudasill Road and field visits to the Rudasill-Sandario intersection did not observe significant safety issues.

Avra Valley Road – El Paso Road to Garvey Road

Avra Valley Road is a county-maintained two-way paved road providing east-west access in the northern part of the study area. The roadway lies in both Pima County and the Town of Marana. The County-owned roadway is designated as a scenic major route in the *Pima County Major Streets and Scenic Routes Plan* (2011 map amendment). This segment of Avra Valley Road was identified as a high-crash concentration segment based on five years of crash data. A field visit identified the following potential safety issues:

- The Avra Valley Road-El Paso Road T-intersection is located on a curve and the El Paso Road approach is angled. Observed travel speeds and posted speed limits appear to be high in relation to the existing intersection geometry and available sight distances on the approaches to the intersection.
- Sight distance is restricted on all approaches to the intersection of Avra Valley Road and Garvey Road due to roadway alignment and foliage.
- A predominant crash type at both intersections are rear-end collisions, many occurring during night time lighting conditions.

Near-term needs included improvements to existing advance warning signs on the Avra Valley Road (larger signs with warning beacons) approaches to the El Paso Road and Garvey Road intersections, increasing the size of existing stop signs at both intersections, removal of sight distance restrictions at both intersections, installation of roadway lighting, and speed studies to determine the need for reducing the posted speed limit. Longer term improvement needs include reconstruction of the El Paso Road approach to Avra Valley Road and construction of left-turn lanes on Avra Valley Road at both intersections.

Twin Peaks Road – Silverbell Road (North) to White Stallion Road

Twin Peaks Road is a county-maintained two-way paved road providing east-west access in the northeastern part of the study area (through Rattlesnake Pass). This roadway is designated as a scenic major route in the *Pima County Major Streets and Scenic Routes Plan* (2011 map amendment) and is a "transition roadway segment" from urban roadway design standards on Silverbell Road (South) and Twin Peaks Road in the Town of Marana to rural design standards in unincorporated Pima County. This segment of Twin Peaks Road was identified as a high-crash concentration segment based on five years of crash data. A field visit identified the following potential safety issues:

- The Twin Peaks - Silverbell Road (North) T-intersection is located on a horizontal and vertical curve on Twin Peaks Road and the intersection design promotes high vehicle speeds for vehicles travelling from urban design conditions to rural design conditions. Roadway curvature combined with pavement-shoulder differential creates crash potential for vehicles that leave the pavement surface. More traditional design of the T-intersection and advance warning signs would result in slower vehicle speeds in this transition area.
- Sight distance is restricted on all approaches to the intersection of Twin Peaks Road and White Stallion Road due to roadway alignment and foliage.

Near-term needs included improvements to existing advance warning signs on the Twin Peaks Road (larger signs with warning beacons) intersection, shoulder maintenance to remove pavement-shoulder differential, and removal of sight distance restrictions at the Twin Peaks Road-White Stallion Road intersection. Longer term improvement needs include reconstruction of the Twin Peaks Road-Silverbell Road (North) T-intersection and curve geometry on Twin Peaks Road, and construction of a left-turn lane on Twin Peaks Road at White Stallion Road.

2.2.2 INTERSECTIONS NEEDS

The roadway segment needs described above include operational, safety, and traffic control needs at intersections. This section provides additional details for improvements to specific intersections based on a review of crash concentrations and the results of field visits to each of the following intersections.

Sandario Road / Manville Road

The Sandario Road / Manville Road intersection is currently a T- intersection with a stop sign on Manville Road. Manville Road and Sandario Road are both two-lane county-maintained paved roadways with Manville Road being a major route and Sandario Road being a scenic major route in the *Pima County Major Streets and Scenic Routes Plan* (2011 map amendment). According to residents and stakeholders, vehicle speeds, limited sight distance, and low lighting levels contribute to crashes at this intersection. Residents and stakeholders suggest that the construction of left-turn lanes at this intersection is needed. A review of crash data and field visits did not identify a significant crash concentration or safety issues; however, the need for all-way stop control or the need for a northbound left-turn lane on Sandario Road for vehicles turning onto Manville Road should be considered as traffic volumes increase or as crashes occur in the future.

Sandario Road / Orange Grove Road

The Sandario Road / Orange Grove Road intersection is currently a two-way stop controlled intersection with stop signs on Orange Grove Road. Orange Grove Road east of Sandario Road is a two-lane non-county-maintained unpaved roadway. Orange Grove Road west of Sandario Road is a two-lane county-maintained paved roadway. Sandario Road is classified as a scenic major route in the *Pima County Major Streets and Scenic Routes Plan* (2011 map amendment). The westbound approach of the intersection does not align with the eastbound approach. Residents and stakeholders suggest that the realignment of Orange Grove Road to form a typical four-legged intersection is needed. A review of crash data and field visits did not identify significant safety issues; however, the need for geometric realignment of Orange Grove Road should be considered as traffic volumes increase or as crashes occur in the future.

Sandario Road / Rudasill Road

The Sandario Road / Rudasill Road intersection is a two-way stop controlled intersection with stop signs on both approaches of Rudasill Road. Rudasill Road and Sandario Road are two-lane county-maintained roadways with Sandario Road being a rural major collector. Sandario Road is classified as a scenic route. According to stakeholders, vehicle speeds, limited sight distance, and low night time lighting levels have contributed to a concentration of crashes at this intersection. Residents and stakeholders suggest that roadway lighting, advance warning signs on the approaches to the intersection, and possibly all-way stop control are needed. A review of crash data and field visits did not identify significant safety issues; however, the need for roadway lighting, warning signs, and intersection control changes should be considered as traffic volumes increase or as crashes occur in the future.

Anway Road / Avra Valley Road

The Anway Road / Avra Valley Road intersection is currently a two-way stop controlled intersection with the Anway Road approaches controlled by stop signs. Avra Valley Road is designated as a scenic major road and Anway Road, south of the intersection is a major road according to the *Pima County Major Streets and Scenic Routes Plan* (2011 map amendment). The intersection was identified as a

location of high-crash concentration based on five years of crash data. A field visit identified the following potential safety issues:

- Observed travel speeds and posted speed limits appeared to be high in relation to the existing horizontal geometry and available sight distances on the approach to the intersection.
- Anway Road alignments approaching the intersection were off-set creating alignment discontinuity for north-south travel.
- Sight distance was restricted on all approaches to the intersections due to roadway alignment and foliage.

Near-term needs included improvements to existing advance warning signs on the Avra Valley Road (larger signs with warning beacons) approaches to the intersection, removal of sight distance restrictions, and speed studies to determine the need for reducing the posted speed limit. Longer term improvement needs include consideration of left-turn lanes on Avra Valley Road, transition an all-way stop control, and realignment of the Anway Road approaches to the intersection.

Avra Valley / Trico Road

The Avra Valley Road / Trico Road intersection is currently a two-way stop controlled intersection with the Trico Road approaches controlled by stop signs. Avra Valley Road is designated as a scenic, major road and Trico Road is a major road according to the *Pima County Major Streets and Scenic Routes Plan* (2011 map amendment). The intersection and its approaches on Avra Valley Road were identified as a location of high-crash concentration based on five years of crash data. A field visit identified the following potential safety issues:

- Observed travel speeds and posted speed limits appeared to be high in relation to the existing horizontal geometry and available sight distances on the approach to the intersection.
- Trico Road alignments approaching the intersection were off-set creating alignment discontinuity for north-south travel.
- Sight distance was restricted on all approaches to the intersections due to roadway alignment and foliage.
- The percentage of crashes occurring during night time conditions may suggest a need for roadway lighting at the Trico Road intersection.

Near-term needs included improvements to existing advance warning signs on the Avra Valley Road (larger signs with warning beacons and warning sign relocation further from the intersection) approaches to the intersection, placement of advance warning signs on Trico Road, removal of sight distance restrictions at the intersection, intersection lighting at the Trico Road intersection, and speed studies to determine the need for reducing the posted speed limit. Longer term improvement needs include construction of left-turn lanes on Avra Valley Road at Trico Road and Voak Road intersections, construction of a right-turn lane on Trico Road (southbound approach), transition an all-way stop control, and realignment of the Trico Road approaches to the intersection.

Sanders Road / Twin Peaks Road

The Sanders Road / Twin Peaks Road intersection is currently a T-intersection with stop control on the Sanders Road approach to the intersection. This intersection is located in the Town of Marana but within the study area limits. The intersection was identified as a location of high-crash concentration based on five years of crash data. A field visit identified the following potential safety issues:

- Observed travel speeds and posted speed limits appeared to be high in relation to the existing vertical geometry associated with the wash on the east approach to the intersection.

Near-term needs included improvements to existing advance warning signs on the Twin Peaks Road (larger signs with warning beacons) approaches to the intersection, placement of advance warning signs on Sanders Road, and speed studies to determine the need for reducing the posted speed limit. Longer term improvement needs include improvements to vertical geometry associated with the wash located on Twin Peaks Road east of the intersection and transition an all-way stop control.

2.3 ROADWAY-FLOODING MITIGATION NEEDS

The roadway segment and intersection needs described above include mitigation of roadway flood-prone areas. This section includes justification for flood mitigation improvements to improve access for study area residents and emergency service providers. All improvement projects should be coordinated to leverage improvement costs.

Manville Road

Manville Road is a two-lane county-maintained rural minor collector that provides east-west access to the southern portion of the study area. The eastern end of Manville Road terminates at the SNP boundary where it intersects Sandario Road. Manville Road has a posted speed limit of 50 mph and has an average daily traffic volume of around 1,000 vpd. Brawley Wash crosses Manville Road just west of the Central Arizona Project (CAP) canal. Hydrological studies and drainage improvements should be considered on Manville Road to mitigate road closures.

Anway Road

Anway Road is a two-lane county-maintained rural minor collector that provides north-south access in the western portion of the study area. Anway Road has a posted speed limit of 50 mph and an average daily traffic volume of around 1,400 vpd. Blanco Wash crosses Anway Road just south of Avra Valley Road. Road closures during flooding events create access issues for the Marana School District, fire department, police department, and other emergency providers. Hydrological studies and drainage improvements should be considered on Anway Road to mitigate road closures.

Avra Valley Road

Avra Valley Road is a two-lane county-maintained rural major collector that provides east-west access in the northern portions of the study area. Avra Valley Road has a posted speed limit of 55 mph and an average daily traffic volume of around 4,000 vpd. Brawley Wash crosses Avra Valley Road east of Anway Road. Road closures during flooding events create access issues for the Marana School District, fire department, police department, and other emergency providers. Hydrological studies and drainage improvements should be considered on Avra Valley Road to mitigate road closures.

Sandario Road

Sandario Road is a county-maintained roadway and is the major north-south access in the study area and has an average daily traffic volume of 4,500 vpd. There are two locations, north of Manville Road and north of Emigh Road, where hydrological studies and drainage improvements should be considered to mitigate road closures.

2.4 ALTERNATE MODES NEEDS

2.4.1 TRANSIT NEEDS

The need for transit service was first demonstrated in the Picture Rocks Transportation Survey conducted by Sun Tran in 2013. The purpose of the survey was to gather information regarding the

transportation needs of the Picture Rocks community from civic groups including the Picture Rocks Community Conversation Transportation Committee, the Pictures Rocks AARP Community Group, and the Elder Initiative. The survey identified a potential location for a park-and-ride lot may be at the Sandario Baptist Church at 6971 North Sandario Road.

Key transit service destinations in the study area include:

- Picture Rocks Community Center
- Sandario Road / Picture Rocks Road intersection
- Arizona Pavilions Shopping area at the Cortaro Road/I-10 interchange

Procedures described in *Transit Cooperative Research (TCR) Program Report 161 – Method for Forecasting Demand and Quantifying Need for Rural Passenger Transportation: Final Workbook,* were used to estimate study area transit needs in two ways:

- The number of people in study area likely to need passenger transportation, and
- The number of person trips required by individuals without personal vehicles (at a level of mobility equal to those having personal vehicles).

Passenger Transportation Need

Estimates of passenger transportation need consider the number of persons residing in the study area with income below the poverty level, estimated to be 1,081 persons (source: US Census Bureau, Table B17001) plus the number of persons residing in households with no vehicles, estimated to be 212 persons (source: US Census Bureau, Table B08201).

Using this methodology, approximately 1,293 persons have passenger transportation needs in the study area.

Person Trips

A second measure of transit need, expressed in daily one-way person trips, was estimated using a factor called the mobility gap which is based on the total number of daily trips not taken by households with zero vehicle availability compared to the number of daily trips taken by households with access to a vehicle. The mobility gap for the Picture Rocks Census Division is 0.8 from TCR Program Report 161.

Using the following formula, with 110 study area households with no vehicles, the estimated transit need was calculated to be 90 one-way trips per day or 26,400 annual one-way passenger trips.

Need (one-way trips per day) = Number of households having no car x mobility gap.

2.4.2 TRANSIT DEMAND

TCRP Report 161 states that the estimate of need using the mobility gap method is typically greater than the number of trips actually observed on rural passenger transportation systems and at best, only about 20 percent of the mobility gap trip-based needs are typically met.

Based on analysis of data reported to the Rural National Transit Database for 2009, *TCRP Report 161* developed the following equation to estimate passenger transportation demand in rural areas:

Demand = (2.20 × Population age 60+) + (5.21 × Mobility Limited Population age 18 to 64) + (1.52 × Residents of Households having No Vehicle)

Using input data presented in **Table 1**, passenger transportation demand was estimated to be 5,638 trips per year for "non-program passenger transportation" (i.e., transportation demand not resulting from participation in a particular social-service transportation program).

Table 1 – Estimate of Reasonable Transit Demand

	Number of Persons – Picture Rocks Census Designated Place
Population Age 60+	2024
Mobility Limited Population age 18 to 64	176
Residents of Households having No Vehicle	212
Non-program related passenger transportation demand[1]	**5,638 Trips per Year**

Sources: U.S Census American Community Survey Tables B101001, S1810, and B08201, 2008-2012 American Community Survey 5-Year Estimates

Transportation demand was addressed by considering daily and peak-period transit service options to determine the best "fit" for the Picture Rocks study area. Transit service options include fixed route service. Deviated fixed route service would be required to provide a complementary paratransit service to meet Americans with Disabilities Act (ADA) requirements, which is discussed in more detail on **Table 3** in **Chapter 3.**

- Fixed route service – a bus travels over an established route with fixed times for stops. It is assumed that paratransit service will be available to meet transportation services for those individuals unable to use the fixed route service due to their disability.

- Deviated fixed route service – a bus or van travels over an established fixed route and keeps to a timetable, but the vehicle can deviate from the route to go to a specific location.

Vanpool service which is currently operating in the Picture Rocks study area on a volunteer basis through the Neighbors Care Alliance (NCA) was not further evaluated as a transit service option for the Picture Rocks study area (the NCA is a program of "neighbors helping neighbors" and is a volunteer organization that is becoming established in the Picture Rocks study area).

The recommended transit service alternative is presented in **Chapter 3**.

2.4.3 PEDESTRIAN NEEDS

The roadway segment needs described above include pedestrian needs documented from input from stakeholders and the public. This section includes additional detail on pedestrian needs that should be addressed in the roadway segments. Pedestrian needs expressed by residents and stakeholders included:

- Pedestrian paths are needed to link the Community Center on Sanders Road, the Sandario Road / Picture Rocks Road intersection, and Marana High School;
- Pedestrian paths are needed along Rudasill Road;
- Conduct and implement a Safe Routes to School program;
- Construct school bus pullouts along Sandario Road and Picture Rocks Road;

- Install crosswalks at the Sandario Road / Picture Rocks Road intersection;
- Construct parking areas and pedestrian facilities at trail head locations at the Manville Road / Sanders Road intersection and at the Rudasill Road / Sanders Road intersection;
- Rudasill Road (Sandario Road to Tula Lane), has high volumes of recreational pedestrians with no pathways or roadway shoulders on which to walk;
- A walking trail along Picture Rocks Road from Sandario to Tula;
- Some type of parking accessibility needs to be provided at intersection of Sandario Rd. and Rudasill Rd. to accommodate the Saguaro National Monument Trailhead at southeast corner of the intersection. Heavy usage by both hikes (especially large groups in multiple vehicles) and horse riders (often 4 or more vehicles with horse trailers); and
- Sidewalks are needed to and from the -cross walks at the intersectin of Sandario Road and Picture Rocks Road. There needs to be a safe pedestrian route from high school to community center.

2.4.4 BICYCLE NEEDS

The roadway segment needs described above address bicycle needs documented from stakeholder and public input. Bicycle needs should be addressed in the roadway segments, including paved shoulders for bikes on Sandario Road, Picture Rocks Road, and sections of Rudasill Road to link the Community Center on Sanders Road, the Sandario Road / Picture Rocks Road intersection, and Marana High School. Bicycle needs expressed by residents and stakeholders included:

- Bike lanes (especially on Sandario Road). Stakeholders noted that bike lane should extend along Sandario Road to Twin Peaks to discourage bicyclists from using Picture Rocks.
- Separated trail/shared use path on Sandario Road, Picture Rocks Road, and Twin Peaks Road.
- Encourage completion of bicycle safety education course for all residents and visitors (these are taught by Pima County Department of Transportation).

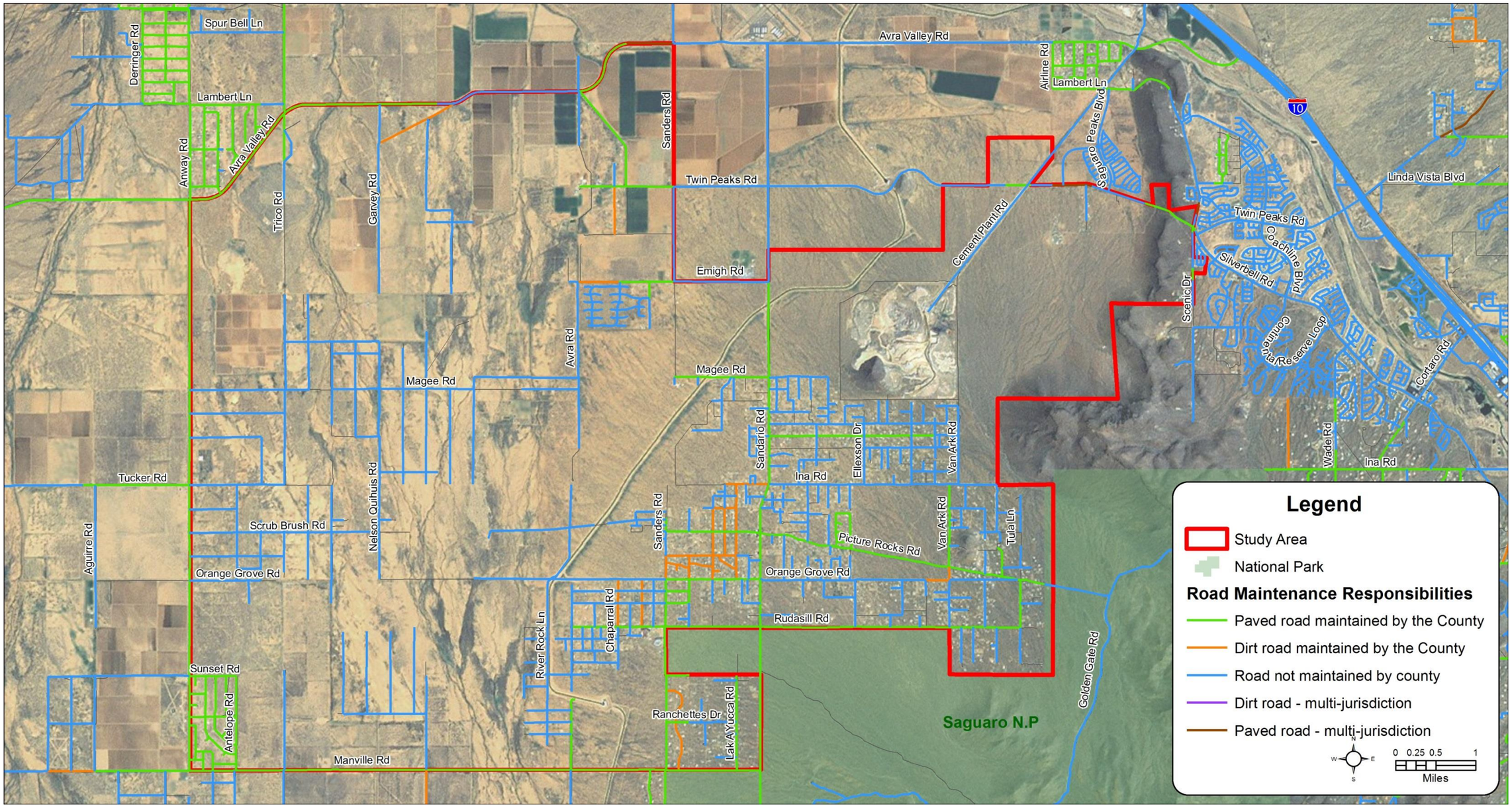
2.5 ROADWAY MAINTENANCE NEEDS

2.5.1 NON-MAINTAINED COUNTY ROADS

Maintenance of County roads was the highest priority roadway infrastructure need in 2013 surveys of Picture Rocks residents conducted as part of the Pima County Comprehensive Plan Update. Currently there are approximately 140 miles of roads in the study area that are not maintained by the County, many of which are unpaved. By comparison, there are approximately 46 miles of paved roads that are maintained by the County or other jurisdictions in the study area, and approximately nine miles of dirt roads that are maintained by the County.

Pima County is responsible for maintaining paved and unpaved roads on the Pima County Maintenance System (refer to **Figure 7**). The County is authorized to spend public funds to maintain only the County Maintenance System. Roads that are not on the County Maintenance System may be placed on the Maintenance System by the Board of Supervisors if the roadway is laid out, constructed, and opened in accordance with County roadway design standards at no cost to Pima County (Pima County Code of Ordinances, Section 10.04.030).

Stakeholder interviews recorded numerous requests for paving, maintaining, and improving roads that are not on the Maintenance System. The Marana Unified School District maintains a map of roads designated by the District as "not travelable" by school buses. All of the designated roads are not on the County Maintenance System except for Avra Road from Sunset Road to Yankee Ranch Road. Other roads in the study area such as Emigh Road are within the jurisdiction of and are maintained by the Town of Marana. Emergency service providers maintain similar maps of roads that become impassible during storm events. Stakeholder comments on road maintenance suggest that there is not a broad public understanding of the requirements for roads to be placed on the Maintenance System and be maintained by the County.

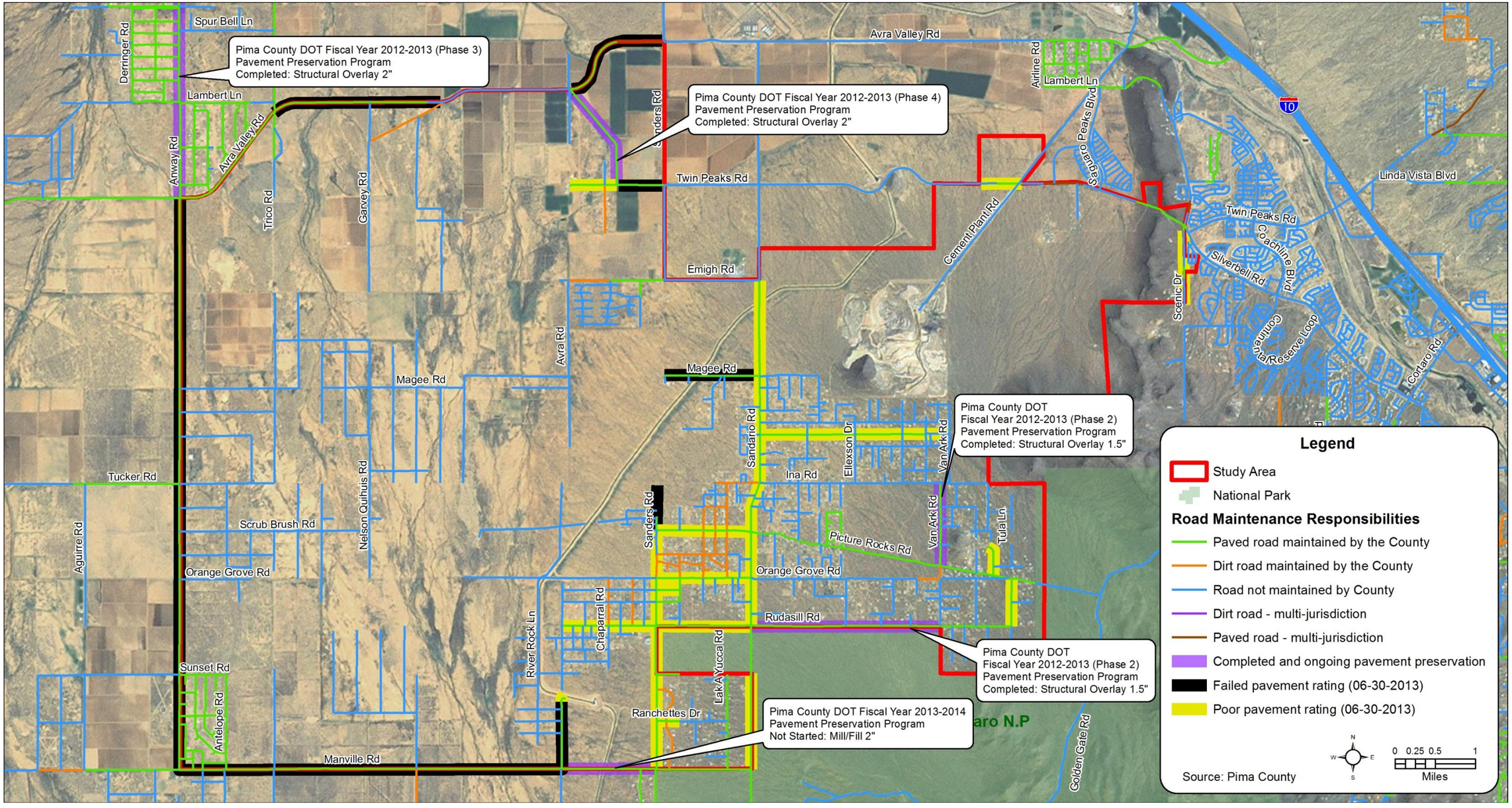


Source: Pima County

Figure 7 – County Maintenance System

2.5.2 PAVEMENT PRESERVATION NEEDS

Pima County administers an annual pavement preservation and rehabilitation program. The program varies annually depending on funding availability. Completed and in-progress pavement preservation and rehabilitation projects within the study area since 2012 are shown in **Figure 8**. Also shown in **Figure 8** are roads with *Failed* and *Poor* pavement conditions as rated by Pima County in 2013. The County-maintained roadway listed as *Failed* and *Poor* in **Figure 8** are priorities for Pima County annual pavement preservation programs in the future.



Source: Pima County

Figure 8 – Pavement Preservation Priorities

3. Recommended Projects

The projects recommended in this chapter address the transportation needs documented in Chapter 2 (Transportation Needs) to improve roadway safety, regional access and mobility, bicycle and pedestrian safety and mobility, and rural transit service. Improvement projects were developed based on needs documented in Working Paper No. 1 and reviewed in this Working Paper (Working Paper No. 2). Pima County has performed safety studies and recommended improvements that should be integrated with the projects recommended in this Working Paper. Initial project scoping was developed by a multi-disciplinary engineering team to determine project features and planning-level cost estimates. The planning-level cost estimates include general costs for items typically associated with similar types of projects.

3.1 ROADWAY INFRASTUCTURE PROJECTS

Eleven roadway infrastructure projects along with related planning and engineering studies were developed to address the infrastructure needs documented in Chapter 2. Project features are provided in **Table 2** and shown geographically in **Figure 9**. Preliminary project costs are subject to further refinement in future scoping and design analysis.

3.2 PAVEMENT MAINTENANCE AND REHABILITATION PROJECTS

Pavement preservation priorities for future updates of the annual pavement preservation and rehabilitation program were identified from 2013 pavement conditions data collected by Pima County as part of the Annual Pavement Preservation and Rehabilitation Program. Pavement priorities include County maintained roadway segments with predominant pavement rating of “poor” or “fair.” These priority segments will require further scoping to determine the preservation techniques such as structural overlay or mill/fill. The estimated cost is $140,000/mile for structural overlay and $200,000/mile for mill/fill. These costs were determined from similar completed and planned pavement preservation projects in the study area. Because the County Pavement Preservation and Rehabilitation Program is dependent on the availability of funds, pavement preservation priorities shown in **Figure 8** should be considered in future annual programs.

Table 2 – Summary of Infrastructure Projects

Project Number	Project Name	Project Features	Preliminary Project Cost ($)
1	Sandario Road, Rudasill Road to North of Emigh Road	Near-Term • Construct multi-use path from Sandario Road / Picture Rocks Road intersection to Emigh Road (Marana High School). • Coordinate with fire district on funding to install a pre-emption traffic signal at fire station. • Upgrade traffic control signs and markings. • Implement speed control devices and/or speed enforcement. • Conduct planning and engineering studies to evaluate the need for left-turn lanes at intersections on Sandario Road-Picture Rocks Road. • Conduct planning and engineering studies to evaluate need for intersection operations, geometric, traffic control, and lighting improvements at Sandario Road / Picture Rocks Road intersection. • Conduct hydrology studies to evaluate the need for improvements to wash crossing on Sandario Road including placement of near-term warning and detour signs in advance of roadway reconstruction. • Conduct a study to develop a planning framework for street design and land use zoning along Sandario Road from Ina Road to Orange Grove Road. The street design framework should include pedestrian and equestrian-scale streetscape consistent with Pima County Comprehensive Plan Special Area Policies. Street elements should encourage slower traffic speeds and may include on-street parking, sidewalks, planters, and street trees. Long-Term • Construct all-weather three-lane roadway with paved (bikeable) shoulders from Ina Road to Orange Grove Road. Design should include intersection and drainage improvements as determined by planning and engineering studies. • Monitor crash history and traffic operations at the Orange Grove Road and Rudasill	$2,500,000 $3,500,000

Project Number	Project Name	Project Features	Preliminary Project Cost ($)
		Road intersections to determine the need for geometric, operational, traffic control, and roadway lighting improvements.	
2	Picture Rocks Road, Guthrie Road to SNP West Boundary	Near-Term • Construct multi-use path from Sandario Road to SNP West Boundary. • Upgrade traffic control signs and markings. • Implement speed control devices and/or speed enforcement. • Conduct planning and engineering studies to evaluate the need for left-turn lanes and operations, geometric, traffic control, and lighting improvements at Sandario Road / Picture Rocks Road intersection. • Implement speed control devices and/or speed enforcement. • Conduct planning and engineering studies to evaluate the need for left-turn lanes at intersections on Picture Rocks Road intersections. • Conduct planning and engineering studies to evaluate need for intersection operations, geometric, traffic control, and lighting improvements at Picture Rocks Road intersections between Stone Mountain Road and SNP boundary. • Conduct hydrology studies to evaluate the need for improvements to wash crossing on Picture Rocks Road including placement of near-term warning and detour signs in advance of roadway reconstruction. • Conduct a study to develop a planning framework for street design and land use zoning along Picture Rocks Road from Guthrie Road to Stone Mountain Road. The street design framework should include pedestrian and equestrian-scale streetscape consistent with Pima County Comprehensive Plan Special Area Policies. Street elements should encourage slower traffic speeds and may include on-street parking, sidewalks, planters, and street trees.	$2,000,000
		Long-Term • Construct all-weather three-lane roadway with paved (bikeable) shoulders from	$3,500,000

Project Number	Project Name	Project Features	Preliminary Project Cost ($)
		Guthrie Road to Stone Mountain Road. Design should include intersection and drainage improvements as determined by planning and engineering studies.	
3	Avra Valley Road—El Paso Road to Garvey Road	Near-Term • Upgrade existing advance warning signs on the Avra Valley Road with larger signs and warning beacons on approaches to the El Paso Road and Garvey Road intersections. Relocate sign placement on approaches to intersections and curves. • Increase the size of existing stop signs at the El Paso Road and Garvey Road intersections. • Remove sight distance restrictions at the El Paso Road and Garvey Road intersections. • Conduct studies to determine the need to install roadway lighting. • Conduct speed studies to determine the need for reducing the posted speed limit. Long-Term • Reconstruct the El Paso Road approach to Avra Valley Road. • Construct left-turn lanes on Avra Valley Road at El Paso Road and Garvey Road intersections.	$300,000 $1,500,000
4	Twin Peaks Road—Silverbell Road (North) to White Stallion Road	Near-term • Upgrade existing advance warning signs on the Twin Peaks Road with larger signs and warning beacons on approaches to the Silverbell Road (north). Relocate sign placement on approaches to intersections and curves. • Grade shoulders to remove pavement-shoulder differential. • Remove sight distance restrictions at the Twin Peaks Road-White Stallion Road intersection. Long-Term • Reconstruct the Twin Peaks Road-Silverbell Road (North) T-intersection and curve geometry on Twin Peaks Road.	$400,000 $2,000,000

Project Number	Project Name	Project Features	Preliminary Project Cost ($)
		• Construct a left-turn lane on Twin Peaks Road at White Stallion Road.	
5	Anway Road / Avra Valley Road	Near-Term • Upgrade existing advance warning signs on the Avra Valley Road with larger signs and warning beacons on approaches to Anway Road. Relocate sign placement on approaches to intersection. • Remove sight distance restrictions. • Conduct speed studies to determine the need for reducing the posted speed limit. Long-Term • Construct left-turn lanes on Avra Valley Road or conduct studies to determine the need to transition to all-way stop control. • Realign the Anway Road approaches to the intersection.	$300,000 $2,500,000
6	Avra Valley / Trico Road	Near-Term • Upgrade existing advance warning signs on the Avra Valley Road with larger signs and warning beacons on approaches to Avra Valley Road. Relocate sign placement on approaches to intersection. • Remove sight distance restrictions at the intersection. • Conduct studies to determine the need for intersection lighting at the Trico Road intersection. • Conduct speed studies to determine the need for reducing the posted speed limit. Long-Term • Construct left-turn lanes on Avra Valley Road at Trico Road and Voak Road intersections and construct a right-turn lane on Trico Road (southbound approach) or conduct studies to determine the need to transition to all-way stop control. • Realign the Trico Road approaches to the intersection.	$300,000 $2,000,000

Project Number	Project Name	Project Features	Preliminary Project Cost ($)
7	Sanders Road / Twin Peaks Road	Near-Term • Upgrade existing advance warning signs on the Twin Peaks Road with larger signs with warning beacons approaches to the intersection. Relocate sign placement on approaches to intersection. • Conduct speed studies to determine the need for reducing the posted speed limit. Long-Term • Reconstruct vertical geometry associated with the wash located on Twin Peaks Road east of the intersection. • Conduct studies to determine the need to transition to all-way stop control.	$200,000 Additional study required
8	Manville Road Drainage Mitigation Project	Near-Term • Conduct hydrology studies to evaluate the need for improvements to wash crossing on Picture Rocks Road including placement of near-term warning and detour signs in advance of roadway reconstruction. Long-Term • Construct all-weather crossing.	$50,000 $4,500,000
9	Anway Road Drainage Mitigation Project	Near-Term • Conduct hydrology studies to evaluate the need for improvements to wash crossing on Picture Rocks Road including placement of near-term warning and detour signs in advance of roadway reconstruction. Long-Term • Construct all-weather crossing.	$50,000 $1,500,000

Project Number	Project Name	Project Features	Preliminary Project Cost ($)
10	Avra Valley Road Drainage Mitigation Project	Near-Term • Conduct hydrology studies to evaluate the need for improvements to wash crossing on Picture Rocks Road including placement of near-term warning and detour signs in advance of roadway reconstruction. Long-Term • Construct all-weather crossing.	$50.000 $1,500,000
11	Sandario Road Drainage Mitigation Project	Near-Term • Conduct hydrology studies to evaluate the need for improvements to wash crossing on Picture Rocks Road including placement of near-term warning and detour signs in advance of roadway reconstruction. Long-Term • Construct all-weather crossing.	$50.000 $1,500,000

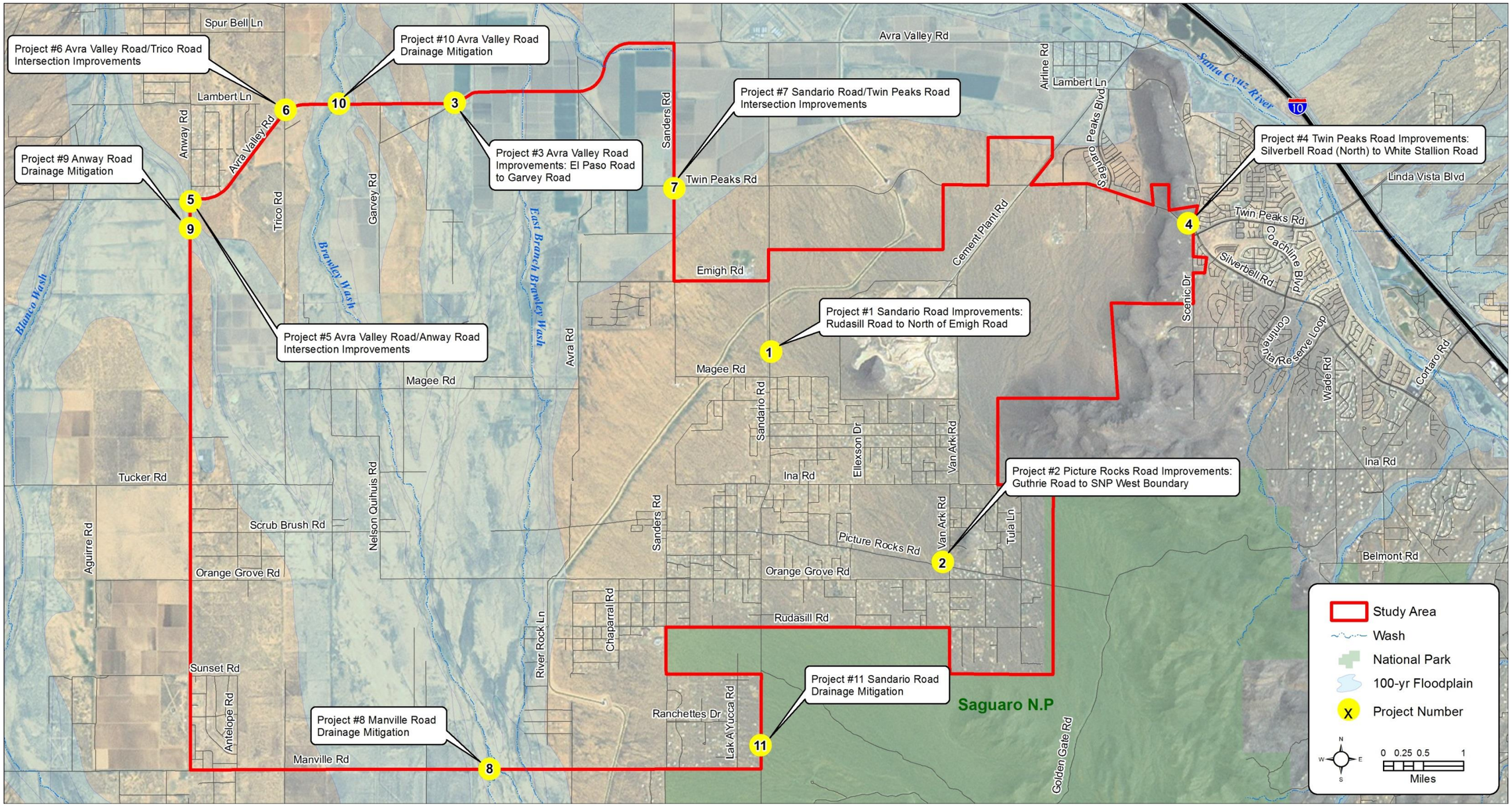


Figure 9 – Recommended Infrastructure Projects

3.2 TRANSIT RECOMMENDATION

This section documents the development and evaluation of transit service and route alternatives to meet the transit service needs in the study area.

3.2.1 TRANSIT SERVICE AND ROUTE ALTERNATIVES EVALUATION

Three transit service and route alternatives were examined for the fixed route service:

- **Alternative 1 - New Transit Route from Picture Rocks Community to Sun Shuttle Route 411 at Twin Peaks Road/ Silverbell Road** – This alternative provides a new transit route that would link to Sun Shuttle Route 411 at the Twin Peaks Road / Silverbell Road intersection. Options for this service are hourly (Alternative 1A) or peak period only (Alternative 1B). This route is shown in **Figure 10.** It is assumed that Alternative 1A would operate 12 hours per day, Monday through Friday, with 60-minute headways. It was assumed that this route would run a shortened six-hour schedule on Saturday. The length of the route is approximately 10.8 miles in one direction. Alternative 1B would provide express service for four hours per day, Monday through Friday with approximately 30-minute headways.
- **Alternative 2 - New Transit Route from Picture Rocks Community to Sun Shuttle Route 411 and Route 104X at Arizona Pavilions Shopping Area** – This alternative provides a new transit route that would link to Sun Shuttle Route 411 and Route 104X at the Arizona Pavilions Shopping area near the Cortaro Road /I-10 interchange. Options for this alternative are hourly (Alternative 2A) or peak period only (Alternative 2B). This route is shown in **Figure 11.** It was assumed that Alternative 2A would operate 12 hours per day, Monday through Friday, with 60-minute headways. It is assumed that this route would run a shortened six-hour schedule on Saturday. The length of the route is approximately 15.4 miles in one direction. Alternative 2B would operate four hours per day, Monday through Friday with approximately 30-minute headways.
- **Alternative 3 - New Transit Route from Picture Rocks Community to Regency Plaza transfer point on Ina Rd near Thornydale Road** – This alternative provides a new transit route that would link the Regency Plaza on Ina and Thornydale Road to the Picture Rocks Community Center via Picture Rocks Road. The Regency Plaza Transfer point serves a number of routes, including Sun Shuttle Routes 412 and 413 and Sun Tran Routes 16 and express route 104X. This route is shown in **Figure 12**. This route is approximately 13.7 miles in one direction. It was assumed that this route would run with 60-minute headways. This route could be expanded to serve the Saguaro National Park Red Hills Visitor Center and other SNP access points such as the trail access points at Manville Road / Sandario Road and the Desert Discovery Nature Trail access on Kinney Road. This route may not be feasible because commercial vehicle traffic is not allowed through the Saguaro National Monument. This route also has the disadvantage of not serving the Marana High School area and residential areas north of Picture Rocks Road. This route may be feasible for the SNP to consider implementing.

Additional features for each transit alternative are summarized in **Table 3**.

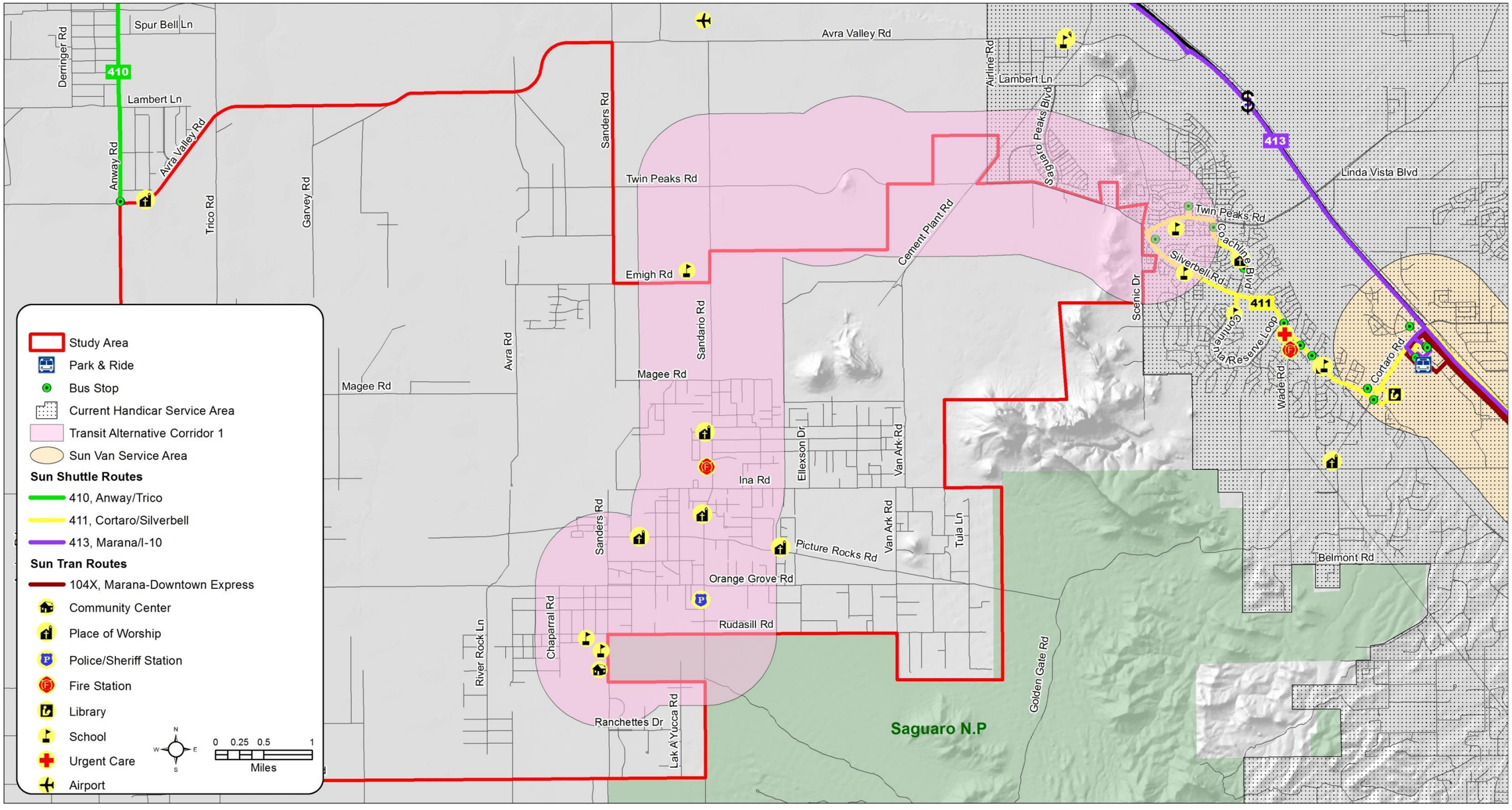


Figure 10 – Transit Alternatives 1A and 1B

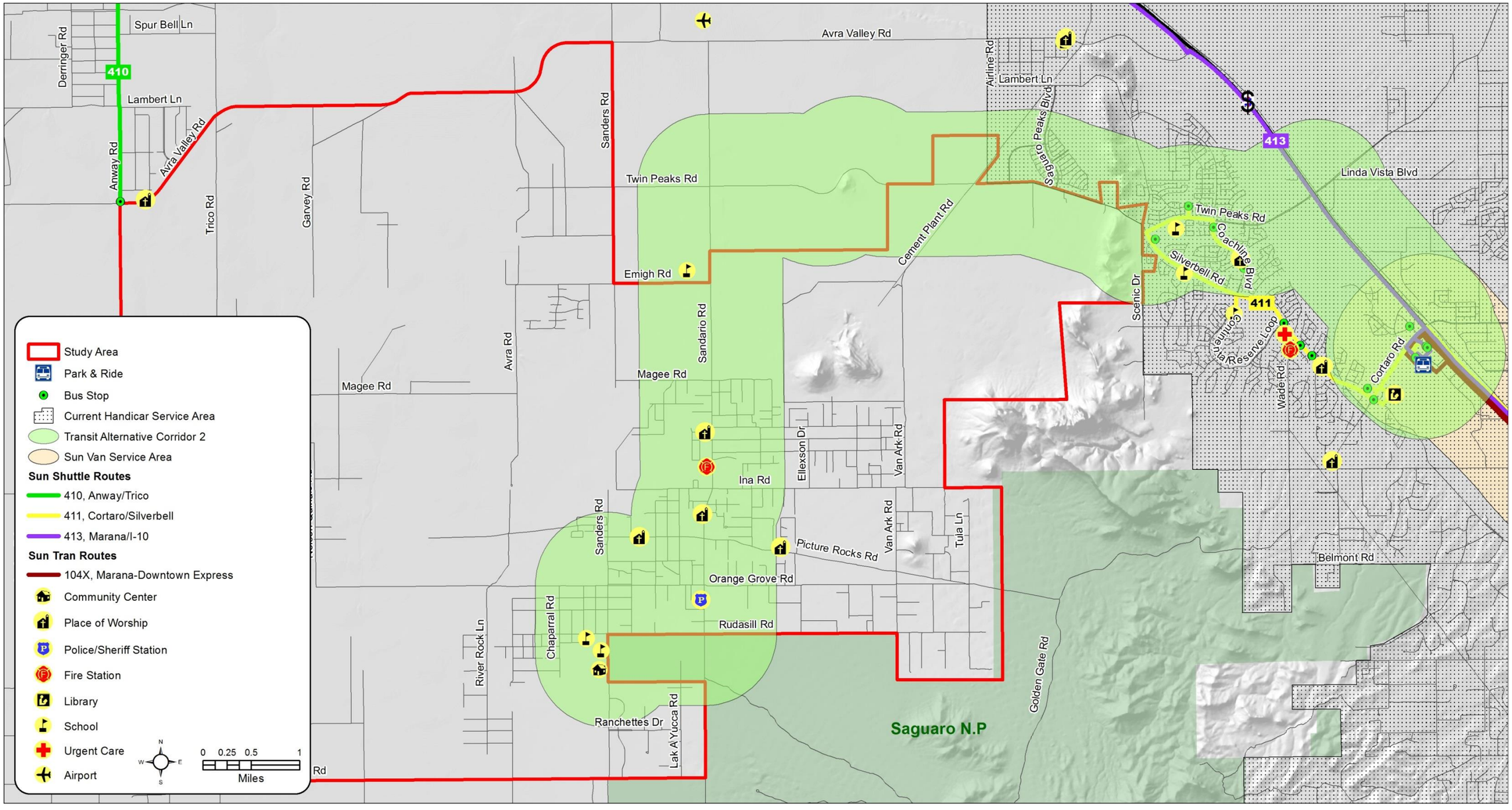


Figure 11 – Transit Alternatives 2A and 2B

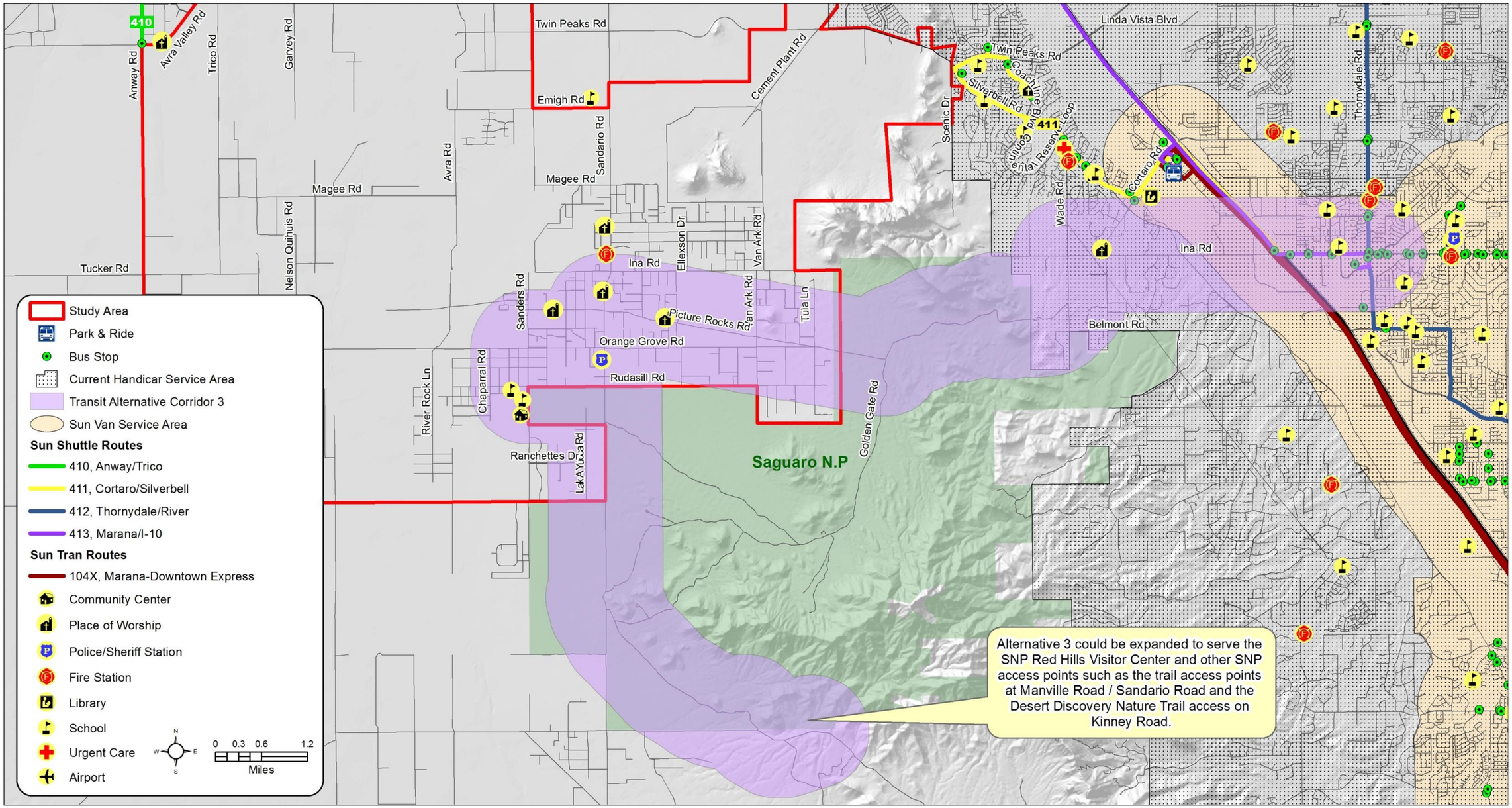


Figure 12 – Transit Alternative 3

Table 3 – Transit Alternatives

Service Alternative	Need for ADA Complimentary Paratransit Service	Service Area Characteristics	Passenger Needs	Costs	Other Comments
Alternative 1 A - New transit route to Route 411 at Twin Peaks Road / Silverbell Road – hourly service	Sun Shuttle vehicles are equipped with lifts. Typically each Sun Shuttle carries two personal mobility devices. ADA complimentary paratransit service is required and would likely need to be provided through a route-deviated service.	Streets served: • Twin Peaks Road (Silverbell Road to Sandario Road) • Sandario Road (Twin Peaks Road to Rudasill Road • Rudasill Road (Sandario Road to Sanders Road) • Sanders Road (Sunset Road to Picture Rocks Road) • Orange Grove Road (Sanders Road to Sandario Road) Key destinations: • Picture Rocks Community Center (Potential park-and-ride) • Commercial area at Picture Rocks Road/ Sandario Road intersection • Picture Rocks Baptist Church T 6971 North Sandario Road (potential site for park-and-ride lot) • Marana High School (within 0.2 miles of route) • Desert Winds Elementary School • Picture Rocks Elementary School • Safeway at Twin Peaks Road/Silverbell Road	This route directly serves the Safeway at Twin Peaks Road/ Silverbell Road. A transfer would need to be made to Route 411 in order to travel to locations such as the Arizona Pavilions area.	Operating and administrative costs= $162,162 Capital costs for system start up: $213,900 - $318,900	According to the PAG Short Range Transit Implementation Plan 2014-2018, Sun Shuttle fixed routes all follow a standard threshold of two passengers per revenue hour. This route is estimated to have 5,638 passengers / 3432 revenue hours = 1.64 passengers /revenue hours Assuming only weekday service, the route is estimated to carry 5,638/ 3,120=1.81 passengers/revenue hour
Alternative 1B - New transit route to Route 411 at Twin Peaks Road / Silverbell Road – peak period only.	Sun Shuttle vehicles are equipped with lifts. Typically each Sun Shuttle carries two personal mobility devices. ADA complimentary paratransit service is required and would likely need to be provided through a route-deviated service.	See above	This express route provides service to the Marana-Downtown Express (Route 104X) at the Arizona Pavilions.	Operating and administrative costs=$49,140 Capital costs for system start up: $318,900 - $423,900	According to the PAG Short Range Transit Implementation Plan 2014-2018, Sun Shuttle fixed routes all follow a standard threshold of two passengers per revenue hour. This route is estimated to have 5,638 passengers / 1,040 revenue hours = 5.42 passengers /revenue hour
Alternative 2A - New transit route to Route 411 and Route 104X at Arizona Pavilions Shopping Center - hourly service.	Sun Shuttle vehicles are equipped with lifts. Typically each Sun Shuttle carries two personal mobility devices. ADA complimentary paratransit service is required and would likely need to be provided through a route-deviated service.	Added key destinations beyond 1A and 1B: • Arizona Pavilions area • Shopping plaza at Twin Peaks Road/ Coachline Road	This route, although longer, serves the Arizona Pavilions area and provides service to more locations. This increases potential ridership.	Operating and administrative costs=$162,162 Capital costs for system start up: $213,900 – $318,900	This route is estimated to have 5,638 passengers / 3,432 revenue hours = 1.64 passengers /revenue hours Assuming only weekday service, the route is estimated to carry 5,638/ 3,120=1.81 passengers/revenue hour
Alternative 2B - Express transit route to Route 411 and Route 104X at Arizona Pavilions Shopping Center – peak period only.	Sun Shuttle vehicles are equipped with lifts. Typically each Sun Shuttle carries two personal mobility devices. ADA complimentary paratransit service is required and would likely need to be provided through a route-deviated service.	Added key destinations beyond 1A and 1B: • Arizona Pavilions area • Shopping plaza at Twin Peaks Road/Coachline Road	This express route provides service to the Marana-Downtown Express (Route 104X) at the Arizona Pavilions.	Operating and administrative costs=$49,140 Capital costs for system start up: $318,900 - $423,900	According to the PAG Short Range Transit Implementation Plan 2014-2018, Sun Shuttle fixed routes all follow a standard threshold of two passengers per revenue hour. This route is estimated to have 5,638 passengers / 1,040 revenue hours = 5.42 passengers /revenue hour

Service Alternative	Need for ADA Complimentary Paratransit Service	Service Area Characteristics	Passenger Needs	Costs	Other Comments
Alternative 3 - New transit route from Picture Rocks Community to Regency Plaza on Ina and Thornydale Road. Regency Plaza Transfer point serves a number of routes, including Sun Shuttle Routes 412 and 413 and Sun Tran Routes 16 and express route 104X – peak period only.	Sun Shuttle vehicles are equipped with lifts. Typically each Sun Shuttle carries two personal mobility devices. ADA complimentary paratransit service is required for portions of this route outside of the current Sun Shuttle service area (refer to Figure 13) and would likely need to be provided through a route-deviated service.	Streets served: • Ina Road (Thornydale Road to Wade Road) • Wade Road (Ina Road to Picture Rocks Road) • Picture Rocks Road (Wade Road to Sandario Road) • Sandario Road (Picture Rocks Road to Rudasill Road • Rudasill Road (Sandario Road to Sanders Road) • Sanders Road (Rudasill Road to Picture Rocks Community Center Road) Key destinations: • Picture Rocks Community Center (Potential park-and-ride) • Commercial area at Picture Rocks Road/ Sandario Road intersection • Picture Rocks Baptist Church T 6971 North Sandario Road (potential site for park-and-ride lot) • Desert Winds Elementary School • Regency Plaza Sun Shuttle Transfer Point	This route, although longer, serves the Regency Plaza Transfer Point which will increases potential ridership.	Operating and administrative costs=$49,140 Capital costs for system start up: $318,900 - $423,900	According to the PAG Short Range Transit Implementation Plan 2014-2018, Sun Shuttle fixed routes all follow a standard threshold of two passengers per revenue hour. This route is estimated to have 5,638 passengers / 1,040 revenue hours = 5.42 passengers /revenue hour

It should be noted that all transit options considered are required to have complimentary paratransit service to meet standards set by ADA. The Sun Van service operates within a specific service area to provide transit service to individuals who, because of their disability, are unable to ride Sun Tran. The Sun Van Service operates within a specific service area, shown in **Figure 13**.

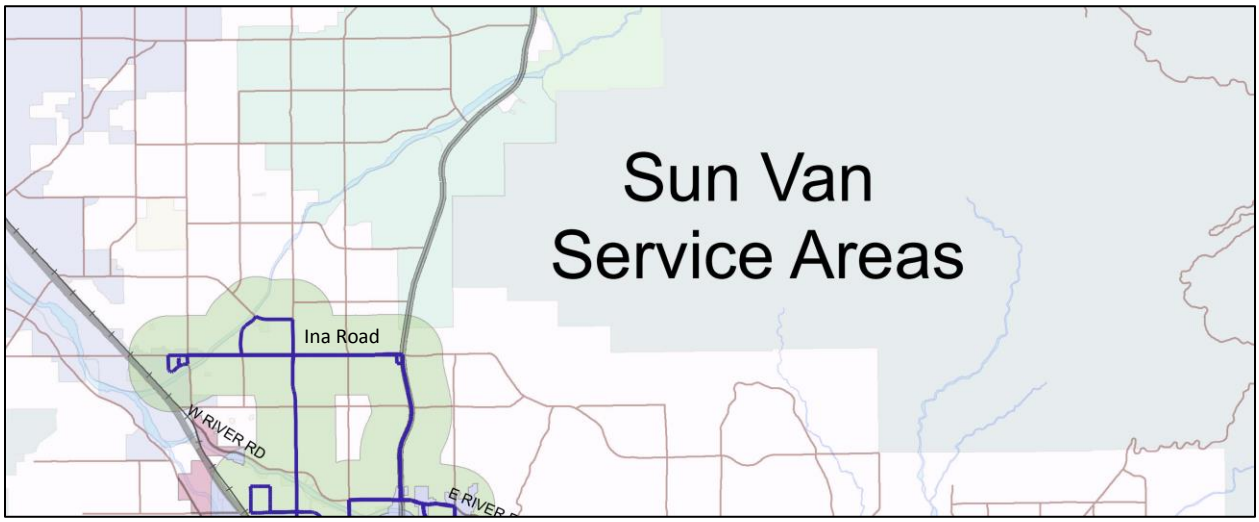


Figure 13 – Sun Van Service Area in Northwest Tucson

Since transit alternatives in Corridors 1 and 2 are outside of this service area, a route deviated service should be provided if an expansion of the Sun Van service area is not feasible. For route-deviated service, passengers can schedule a pick-up or drop-off within 3/4 mile of Sun Shuttle routes.

3.2.2 REVENUE HOURS, REVENUE MILES, AND COSTS

Revenue Hours and Revenue Miles

A key input to the evaluation of alternatives is the annual revenue hours and revenue miles for each alternative are provided in **Table 4.**

Revenue miles are higher for the Alternative 2 options because this route is longer. However, it serves the key destination of Arizona Pavilions more directly.

Estimated Non-Capital Costs

Estimated system non-capital costs (administrative and operating) costs were developed using historic cost per revenue hour data from the Pima Association of Governments (PAG). Applying the average cost per revenue hour to the transit alternatives results in the estimated operating and administrative costs shown in **Table 5.**

Table 4 – Estimated System Non-Capital (Administrative and Operating) Costs

Alternative	Total Vehicle Revenue Hours	Estimated Cost per Revenue Hour*	Total Estimated Administrative and Operating Costs
Alternative 1A - New Transit Route to Sun Shuttle Route 411 at Twin Peaks Road/ Silverbell Road	3,432	$47.25	$162,162
Alternative 1B - Express Transit Route to Sun Shuttle Route 411 at Twin Peaks Road/ Silverbell Road	1,040	$47.25	$49,140
Alternative 2A - New Transit Route to Sun Shuttle Route 411 and Route 104X at Arizona Pavilions Shopping Center	3,432	$47.25	$162,162
Alternative 2B - Express Transit Route to Sun Shuttle Route 411 and Route 104X at Arizona Pavilions Shopping Center	1,040	$47.25	$49,140
Alternative 3 - New transit route to Regency Plaza on Ina and Thornydale Road Regency Plaza Transfer point serves a number of routes, including Sun Shuttle Routes 412 and 413 and Sun Tran Routes 16 and express route 104X – peak period only.	1,040	$47.25	$49,140

*Source: Pima Association of Governments, based on historic costs per revenue hour over the past three years

Table 5 – Annual Revenue Hours and Revenue Miles for Transit Alternatives

	Revenue Hours				Revenue Miles				
Alternative	Revenue Hours per week	Weeks per year	Revenue Hours per Year	Number of vehicles	Route Miles per round trip	Number of trips per week	Revenue Miles per week	Number of vehicles	Total Vehicle Revenue Miles
Alternative 1A - New Transit Route to Sun Shuttle Route 411 at Twin Peaks Rd/ Silverbell Rd	66	52	3,432	1	21.6	73	1,577	1	1,577
Alternative 1B - Express Transit Route to Sun Shuttle Route 411 at Twin Peaks Rd/ Silverbell Rd	20	52	1,040	2	21.6	30	648	2	1,296
Alternative 2A - New Transit Route to Sun Shuttle Route 411 and Route 104X at Arizona Pavilions Shopping Center	66	52	3,432	1	30.8	73	2,248	1	2,248
Alternative 2B - Express Transit Route to Sun Shuttle Route 411 and Route 104X at Arizona Pavilions Shopping Center	20	52	1,040	2	30.8	30	924	2	1,848
Alternative 3 - New transit route to Regency Plaza on Ina Rd and Thornydale Rd	20	52	1,040	2	27.4	30	822	2	1644

Estimated Capital Costs

Capital costs include the cost of buses, bus shelters, and bus stop signs. For this study a range of costs are provided for the number of buses required, because the specific bus needs would need to be refined based on a more detailed implementation plan that would define specific bus stops and route timing and headways.

Buses
The buses used for the Sun Shuttle service are light duty vehicles that are equipped with a lift and the ability to carry as many as two personal mobility devices. Based on costs for the Sun Shuttle fleet replacement, the average vehicle cost is $105,000. Since the exact routing and number of bus stops is subject to more detailed analysis, a range of buses needed for each alternative is assumed.

Bus Stop Signs
Bus stop signs will need to be erected at all designated bus stop locations. At larger bus stop locations and locations where right-of-way is available to provide a bus shelter, these can encourage ridership particularly during the summer months.

Capital cost assumes bus stop signs and bus shelters at nine stop locations, which are:

- Picture Rocks Community Center (also could potentially serve as a park-and-ride location).
- Intersection of Sanders Road / Rudasill Road (two stops—inbound and outbound). This location serves a number of schools.
- Sandario Road / Picture Rocks Road (two stops—inbound and outbound). This stop location serves a commercial area.
- Sandario Road / Camper Road (two stops—inbound and outbound). This stop location is near the Sandario Baptist Church on Camper Road, which may serve as a potential park-and-ride location.
- Sandario Road / Emigh Road (two stops—inbound and outbound). This stop location serves Marana High School.

A summary of capital costs by alternative is provided in **Table 6.**

Table 6 – Capital Costs - Transit System Start up

Alternative	Buses	Bus Stop Signs	Bus Shelters	Total Capital Costs
Alternative 1A - New Transit Route to Sun Shuttle Route 411 at Twin Peaks Road / Silverbell Road	1*$105,000=$105,000 2*$105,000=$210,000	9*$100=$900	9*$12,000=$108,000	$213,900 - $318,900
Alternative 1B - Express Transit Route to Sun Shuttle Route 411 at Twin Peaks Road/ Silverbell Road	2*$105,000=$210,000 3*$105,000=$315,000	9*$100=$900	9*$12,000=$108,000	$318,900 - $423,900
Alternative 2A - New Transit Route to Sun Shuttle Route 411 and Route 104X at Arizona Pavilions Shopping Center	1*$105,000=$105,000 2*$105,000=$210,000	9*$100=$900	9*$12,000=$108,000	$213,900- $318,900
Alternative 2B - Express Transit Route to Sun Shuttle Route 411 and Route 104X at Arizona Pavilions Shopping Center	2*$105,000=$210,000 3*$105,000=$315,000	9*$100=$900	9*$12,000=$108,000	$318,900- $423,900
Alternative 3 - New transit route to Regency Plaza on Ina Rd and Thornydale Rd	1*$105,000=$105,000 2*$105,000=$210,000	9*$100=$900	9*$12,000=$108,000	$213,900 - $318,900

3.2.1 RECOMMENDED TRANSIT ALTERNATIVE

Future transit service in the Picture Rocks area is dependent upon funding. Commitment of local funding is decided by PAG in consideration of regional needs and priorities. If funding can be identified, it is recommended that route Alternative 2B - Express Transit Route to Sun Shuttle Route 411 and Route 104X at Arizona Pavilions Shopping Center be initially implemented. Providing peak-hour service to the Arizona Pavilions area will help to encourage and grow ridership demand, while providing a cost–effective service.

4. Project Prioritization and Plan of Improvements

4.1 NEAR-TERM PROJECT PERFORMANCE EVALUATION

Project performance criteria were developed to provide a basis for establishing near-term infrastructure project priorities. Long-term projects which require higher construction costs will be dependent on funding availability and to the outcome of studies that are recommended for project scoping. The performance criteria include measurable factors representing the goals of the Picture Rocks Study. These criteria cover three categories—study area multimodal mobility and safety, regional multimodal accessibility, and study area economic development and quality of life. The performance criteria are defined below and included in the project priority matrix in **Table 7**.

Study Area Multimodal Mobility and Safety

- **Improved Multimodal Mobility within the Picture Rocks Community** – Each improvement project was evaluated on how well it improved multimodal connectivity within the Picture Rocks Community and the study area in general. Projects that address mobility and accessibility between Community facilities and neighborhoods for all modes rated very high for this criterion.
- **Improved Multimodal Safety** – Each improvement project was evaluated on how well it improved multimodal safety in the study area with a focus on crash concentration locations. Projects that address safety improvement for all roadway users rated very high for this criterion.
- **Improved Traffic Operations** – Each improvement project was evaluated on how well it improved multimodal capacity and operations. Projects that improve traffic operations through improved traffic control and added capacity rated very high for this criterion.

Regional Multimodal Accessibility

- **Improved Regional Multimodal Connections** – Each improvement project was evaluated on how well it improves multimodal Community accessibility with regional transportation features and destinations. Projects that address connectivity to Marana, I-10, and regional employment centers and destinations rated very high for this criterion.
- **Increased Travel Choices** – Each improvement project was evaluated on how well it increased multimodal transportation choices for the Community. Projects that address multimodal and transit service needs rated very high for this criterion.

Study Area Economic Development and Quality of Life

- **Improved Potential for Community Development** – Each improvement project was evaluated on its contribution to community-scale development. Projects that improve aesthetics, land use controls, and sustainable community development rated very high for this criterion.
- **Improve Quality of Life/Air Quality** – Each improvement project was evaluated on how well it improves quality of life and air quality. Projects that increase the use of alternate modes of transportation and address pavement condition needs rated very high for this criterion.

Performance criteria were rated for each infrastructure project on the following quantitative rating scale to illustrate the benefits of each project.

- Significant Benefit (with a value of 5 points)
- Moderate Benefit (with a value of 3 points)
- Limited Benefit (with a value of 1 point)

Rating scores were used to establish a relative priority for each near-term project.

Table 7 – Near-Term Project Priority Matrix

				Performance Criteria						
				Study Area Multimodal Mobility and Safety			Regional Multimodal Accessibility		Study Area Economic Development and Quality of Life	
Project No.	Near-Term Project	Location	Project Ranking	Improved Multimodal Community Mobility	Improved Multimodal Safety	Improved Traffic Operations	Improved Regional Multimodal Connections	Increased Travel Choices	Improved Potential for Community Development	Improve Quality of Life/Air Quality
1	Sandario Road Improvement Project	Sandario Road, Rudasill Road to Emigh Road	1	5	5	5	5	5	5	3
2	Picture Rocks Road Improvement Project	Picture Rocks Road, Sandario Road to SNP West Boundary	1	5	5	5	5	5	5	3
3	Avra Valley Road Improvement Project	Avra Valley Road—El Paso Road to Garvey Road	3	3	5	5	1	3	1	3
4	Twin Peaks Road Improvement Project	Twin Peaks Road—Silverbell Road (North) to White Stallion Road	2	3	5	5	3	3	1	3
5	Anway Road / Avra Valley Road Improvement Project	Anway Road / Avra Valley Road Intersection	3	3	5	5	1	3	1	3
6	Avra Valley / Trico Road Improvement Project	Avra Valley / Trico Road Intersection	3	3	5	5	1	3	1	3
7	Sanders Road / Twin Peaks Road Improvement Project	Sanders Road / Twin Peaks Road Intersection	3	3	5	5	1	3	1	3
8	Manville Road Drainage Mitigation Project	Manville Road	4	5	3	3	1	1	1	5
9	Anway Road Drainage Mitigation Project	Anway Road	4	5	3	3	1	1	1	5
10	Avra Valley Road Drainage Mitigation Project	Avra Valley Road	4	5	3	3	1	1	1	5
11	Sandario Road Drainage Mitigation Project	Sandario Road	4	5	3	3	1	1	1	5

Rating scale: 5 = Significant Benefit; 3 = Moderate Benefit; 1 = Limited Benefit

4.2 PROJECT PRIORITIES

Using the project priority matrix, projects were assigned to short-range, mid-range, and long-range time frames to maximize benefit to the Picture Rocks Community. Pima County should consider these priorities in future updates of the Transportation Improvement Program and the Long-Range Transportation Plan.

4.2.1 SHORT-RANGE PRIORITIES (0 TO 5 YEARS)

- Pavement Preservation (Funding Dependent)
- Picture Rocks Road, Sandario Road to SNP West Boundary
- Sandario Road, Rudasill Road to Emigh Road

4.2.2 MID-RANGE PRIORITIES (6 TO 10 YEARS)

- Twin Peaks Road, Silverbell Road (North) to White Stallion Road
- Anway Road / Avra Valley Road Intersection
- Avra Valley / Trico Road Intersection
- Sanders Road / Twin Peaks Road Intersection
- Avra Valley Road, El Paso Road to Garvey Road

4.2.3 LONG-RANGE PRIORITIES (11 TO 20 YEARS)

- Manville Road Drainage Mitigation Project
- Anway Road Drainage Mitigation Project
- Avra Valley Road Drainage Mitigation Project
- Sandario Road Drainage Mitigation Project

5. Funding Sources for Transportation Projects

5.1 HIGHWAY USER REVENUE FUND (HURF)

In Arizona, highway construction, operation, and maintenance are principally funded through state-shared revenues known as Highway User Revenue Funds (HURF). HURF revenues are generated by gasoline and use fuel taxes, motor carrier fees, vehicle license taxes, motor vehicle registration fees, and other miscellaneous fees. These revenues are distributed to the cities, towns, and counties of the state and to the State Highway Fund, which is administered by ADOT. These taxes and fees represent a source of revenues available for highway-related expenses.

HURF revenues increased steadily through Fiscal Year (FY) 2006/07. Decreases in HURF since FY 2006/07 placed 2012 HURF distributions of approximately $45 million at a level similar the HURF distribution levels lower than 13 years ago.

HURF growth has declined, as well as the fund losses associated the State legislature's discretionary authority under ARS 28-6537 to divert up to $20M of the fund each session. In addition, they also diverted other funds including the Vehicle Licensing Tax which sometimes supplements HURF Federal funding sources.

5.2 FEDERAL FUNDING SOURCES

Federal programs authorized under *Moving Ahead for Progress in the 21st Century* (MAP-21) include the Surface Transportation Program (STP), Highway Safety Improvement Program (HSIP), Federal Lands Transportation and Access Programs, Tribal Transportation Program, Railway-Highway Crossings (RHC), Transportation Alternatives (TA) Program, National Highway Performance (NHP) Program, and other relevant programs. Federal funding for transportation improvements is available through these programs, subject to eligibility requirements and approval by ADOT and the Federal Highway Administration (FHWA). Utilizing federal funds requires obtaining environmental, utility, and right-of-way clearances before proposed improvements can be implemented. The federal programs under MAP-21 are described in more detail in **Table 8**.

5.3 OTHER FUNDING SOURCES

Pima County adopted transportation impact fees (TIFs) in 1997. State law prohibits the use of TIFs on any highway improvements other than capacity improvements, and the roadway must be located in the unincorporated area of Pima County in geographic benefit areas. TIFs have limited applicability in the study area. TIFs have been used productively to augment transportation capacity improvements throughout Pima County. Other potential sources of funding are listed in **Table 9**.

Table 8 – MAP-21 Federal Programs

Program Name	Description
National Highway Performance Program (NHPP)	Under MAP-21, the enhanced National Highway System (NHS) is composed of approximately 220,000 miles of rural and urban roads serving major population centers, international border crossings, intermodal transportation facilities, and major travel destinations. It includes the Interstate System, all principal arterials (including some not previously designated as part of the NHS) and border crossings on those routes, highways that provide motor vehicle access between the NHS and major intermodal transportation facilities, and the network of highways important to U.S. strategic defense (STRAHNET) and its connectors to major military installations. MAP-21 establishes a performance basis for maintaining and improving the NHS.
Surface Transportation Program (STP)	MAP-21 continues the STP, providing an annual average of $10 billion in flexible funding that may be used by States and localities for projects to preserve or improve conditions and performance on any Federal-aid highway, bridge projects on any public road, facilities for non-motorized transportation, transit capital projects, and public bus terminals and facilities.
Highway Safety Improvement Program (HSIP)	Safety throughout all transportation programs remains the number one priority. MAP-21 continues HSIP, with average annual funding of $2.4 billion, including $220 million per year for the Rail-Highway Crossings program. HSIP emphasizes a data-driven, strategic approach to improving highway safety on all public roads that focuses on performance. The foundation for this approach is a safety data system, which each State is required to have to identify key safety problems, establish their relative severity, and then adopt strategic and performance-based goals to maximize safety.
Congestion Mitigation and Air Quality (CMAQ)	The CMAQ program provides a flexible funding source to State and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act. CMAQ funding is currently restricted for use within Maricopa Association of Governments planning area, under ADOT's discretionary powers.
Transportation Alternatives (TA)	MAP-21 establishes a new program to provide for a variety of alternative transportation projects that were previously eligible activities under separately funded programs. Eligible activities include: -Transportation alternatives (new definition incorporates many transportation enhancement activities and several new activities) -Recreational trails program (program remains unchanged) -Safe routes to schools program -Planning, designing, or constructing roadways within the right-of way of former Interstate routes or other divided highways.
Federal Lands and Tribal Transportation Programs	MAP-21 creates a unified program for Federal lands transportation facilities, Federal lands access transportation, and tribal facilities. The Federal Lands Transportation Program provides funding annually for projects that improve access within the Federal estate, such as national forests and national recreation areas, on infrastructure owned by the Federal government. This program combines the former Park Roads and Refuge Roads programs, and adds three new Federal land management agency (FLMA) partners. The Federal Lands Access Program provides funding annually for projects that improve access to Federal lands on infrastructure owned by States and local governments.
Emergency Relief	The Emergency Relief (ER) program assists Federal, State, tribal, and local governments with the expense of repairing serious damage to Federal-aid, tribal, and Federal Lands highways resulting from natural disasters or catastrophic failures.
Workforce Development and DBE	MAP-21 continues current law goals for use of small business concerns owned and controlled by socially and economically disadvantaged individuals. On-the-Job Training and Disadvantaged Business Enterprise (DBE) Supportive Services programs are continued without change.
Bridge and Tunnel Inspection	To provide for continued improvement to bridge and tunnel conditions essential to protect the safety of the traveling public and allow for the efficient movement of people and goods on which the U.S. economy relies, MAP-21 requires inspection and inventory of highway bridges and tunnels on public roads. No dedicated funds are provided for inspections, but it is an eligible use of NHPP, STP, HSIP, FHWA administrative, Tribal Transportation, and Research funds.
Projects of National and Regional Significance	MAP-21 authorizes funding in FY 2013 only, to fund critical high-cost surface transportation capital projects that will accomplish national goals. States, tribes, transit agencies, and multi-State or multi-jurisdictional groups of these entities are eligible to apply for competitive grant funding.

Table 9 – Other Funding Sources

Program Name	Description
Bonds	Municipal bonds are securities that are issued for the purpose of financing the infrastructure needs of the issuing municipality. These needs vary greatly but can include schools, streets and highways, bridges, hospitals, public housing, sewer and water systems, power utilities, and various public projects. Municipal bonds may be general obligations of the issuer or secured by specified revenue.
General Funds	In public sector accounting, the primary or catchall fund of a government is called the general fund. It records all assets and liabilities of the entity that are not assigned to a special purpose fund. It provides the resources necessary to sustain the day-to-day activities and thus pays for all administrative and operating expenses. General funds generally receive revenue from sources such as state-shared income and sales taxes, local sales tax, and licensing fees.
Property Tax	A municipality or county can levy a property tax for general purposes or for a specific purpose that has a time limit or can extend until rescinded or revised. The property tax amount is based on a percentage of the assessed value of the property.
Sales Tax	A municipality or county can levy a sales tax for general purposes or for a specific purpose such as transportation, it can have a time limit or can extend until rescinded or revised. A sales tax is charged at the point of purchase for certain goods and services. The tax amount is usually calculated by applying a percentage rate to the taxable price of a sale and adding the tax to the price at the point of sale.
Impact Fees	A fee imposed on property developers by municipalities for the new infrastructure that must be built or increased due to new property development. These fees are designed to offset the impact of the additional development and residents on the municipality's infrastructure and services.
Community Facilities Districts	The Arizona Community Facilities District Act addresses a critical issue for developers: the financing of increasingly costly infrastructure requirements without unduly burdening the developer. The law authorizes bonds to be issued and repaid with a mechanism that taxes (or assesses) only the lands directly benefiting from the new infrastructure. This allows community development which would otherwise be unfeasible due to the prohibitive costs. All community facilities districts are required to be included within an incorporated city or town.
Improvement Districts	An improvement district allows a local government agency to levy and collect special assessments on property that is within the boundaries of the improvement district for the purpose of making infrastructure improvements within the improvement district.
Community Development Block Grant Program (CDBG)	The Arizona Department of Housing administers the federal CDBG program for non-entitlement areas (i.e., communities with a population below 50,000). Communities receiving CDBG funds from the State may use the funds for many kinds of community development activities including, but not limited to acquisition of property for public purposes; construction or reconstruction of streets, sidewalks, pathways, water and sewer facilities, neighborhood centers, recreation facilities, and other public works; public services; and planning activities. A local funding match is typically required. http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs
Federal Emergency Management Agency (FEMA) Grant Program	The Arizona Division of Emergency Management administers several FEMA pre-disaster and post-disaster grant programs. The goal of these programs is to prevent and mitigate hazards. Grant programs include the following: • Pre-Disaster Mitigation Program; • Hazard Mitigation Grant Program; • Flood Mitigation Assistance Program; • Repetitive Flood Claims Program; and • Severe Repetitive Loss Program. A local funding match is typically required. http://www.fema.gov/government/grant/index.shtm
Governor's Office of Highway Safety	The Arizona Governor's Office of Highway Safety (GOHS) is the focal point for highway safety issues in Arizona. Funding is available for issues considered high priorities at a statewide level. Projects typically funded include public education and awareness campaigns.